DOCUMENT RESUME

ED 040 544 24 EC 005 942

AUTHOR	Bahlke, Susan J.
TITLE	Componential Evaluation of Creativity Instructional Materials. Final Report.
INSTITUTION	Purdue Univ., Lafayette, Ind.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Bureau of Research.
BUREAU NO	BR-7-E-205
PUB DATE	Nov 69
GRANT	OEG-0-8-070205-3473
NOTE	172p.; A doctoral thesis prepared by the author and presented to the faculty of Purdue University.
EDRS PRICE	EDRS Price MF-$0.75 HC-$8.70
DESCRIPTORS	Audiovisual Aids, *Creative Thinking, *Creativity, *Exceptional Child Research, Instructional Materials, Intermode Differences, Language Ability, *Language Development, Learning Activities, *Material Development, Problem Solving

ABSTRACT

Instructional materials designed to increase creative thinking abilities and language achievement were used in nine training conditions with children in grades 4, 5, and 6. Results indicated that treatment conditions were most effective at the 4th grade level, where at least one treatment was effective for all variables. At the 5th grade, two variables, verbal fluency and verbal originality, were unaffected. The materials were least effective at the 6th grade, where gains occurred on only three variables: nonverbal fluency, nonverbal flexibility, and verbal originality. At all grade levels, treatment conditions were generally more effective when involving either exercise or single component conditions. (Author/JD)

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FORM 0801

BR 7-E-205
PA 24

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ED0 40544

FINAL REPORT
Project No. 7-E-205
Grant No. OEG-0-8-070205-3473

COMPONENTIAL EVALUATION OF CREATIVITY INSTRUCTIONAL MATERIALS

A Thesis by
Susan J. Bahlke
under the direction of
Professors John F. Feldhusen
(Principal Investigator)
and Donald J. Treffinger
Purdue University
Lafayette, Indiana

November 1969

EC005942

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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COMPONENTIAL EVALUATION OF CREATIVITY INSTRUCTIONAL MATERIALS

A Thesis
Submitted to the Faculty
of
Purdue University
by
Susan Joyce Moore Bahlke
In Partial Fulfillment of the
Requirements for the Degree
of
Doctor of Philosophy
January 1969

ACKNOWLEDGMENTS

The author is grateful for assistance from the many individuals concerned with this study.

Special appreciation is extended to Dr. John F. Feldhusen, her major professor, for his continual encouragement and advice throughout the entire course of study and during the writing of this thesis.

The author is likewise thankful to other members of the committee -- Dr. J. W. Asher, Dr. G. E. Gruen, and Dr. W. W. Crowder -- for their help and support.

The author is appreciative of the time and effort spent by Dr. Donald J. Treffinger in the critical reading of this manuscript.

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ABSTRACT

Bahlke, Susan Joyce Moore. Ph.D., Purdue University, January 1969. Componential Evaluation of Creativity Instructional Materials. Major Professor: John F. Feldhusen.

The purpose of this research was to evaluate the componential training effects of a series of 28 audio tapes and printed exercises which were designed to develop children's abilities in the divergent thinking functions of originality, flexibility, fluency, and elaboration, and to facilitate their learning of language skills.

The instructional materials evaluated consisted of a brief presentation of a principle for creative thinking, a story about a pioneer, and written exercises stressing creativity and providing an opportunity for unevaluated, reinforced practice.

The sample consisted of 54 classes drawn randomly from a population of approximately 100 fourth, fifth, and sixth grade classes in an urban school system, and assigned randomly to one of nine treatment conditions. There were six classes, two at each grade level, in each treatment group.

Each of the three parts of the training system was presented separately, in pairs, and all together for a total of seven experimental arrangements. In addition, two control groups were used: one group which received both the pretest and the posttest, and another group which received the posttest only. The posttest only group was subsequently dropped because of sampling problems.

Prior to the beginning of the use of the experimental instructional materials, the *Minnesota Tests of Creative Thinking* were administered to all experimental groups and to the pretested control group as the pretest. The instructional materials were administered by the classroom teacher twice a week for fourteen weeks. At the conclusion of the series of 28 programs, the *Torrance Tests of Creative Thinking*, Form A (TTCT), were administered to all experimental groups and to both control groups. Data gathered from the school records included the IQ and the grades from the previous year. In addition, the teachers rated each child's creative ability. The participating teachers were administered the TTCT, Form A. The *Iowa Tests of Basic Skills* were administered by the school system approximately one month after the posttest. These scores were obtained also.

In the statistical evaluation of the data, a three-factor factorial analysis of covariance was used to test the principal hypotheses concerning the effects of the instructional materials. The pretest scores were used as the covariates; in addition, IQ and language achievement scores were added as covariates for the verbal creativity variables. The secondary hypotheses were tested by means of correlations between the pupils' and teachers' creativity scores, and between the pupils' creativity scores and the teacher's rating of their creative ability.

Results of this research indicate that certain components of the creativity instructional materials were effective in increasing children's creative thinking abilities and language achievement. However, the results were selective in that there was no component or combination of the components that was uniformly effective for all grades over all creativity and language achievement variables. In general, the treatment conditions were most effective at the fourth grade level, where at least one treatment was effective for all creativity variables and for language achievement. At the fifth grade, two variables were unaffected by the instructional materials: verbal fluency and verbal originality. The materials were least effective at the sixth grade where gains were noted on only three variables: nonverbal fluency, nonverbal flexibility, and verbal originality.

At all grade levels, the single component treatment conditions were generally more effective than the multiple component conditions. Those treatment conditions containing the exercises, either alone or in combination with another component, were generally more effective than those treatment conditions which did not involve the exercises.

CHAPTER I

INTRODUCTION

In all phases of life today, the need for new and fresh ways of solving problems is apparent. The consequences of present and future efforts to gain understanding and control of creative performances are incalculable for the future of mankind. It is apparent that the solutions to numerous problems are dependent upon the improvement and utilization of the education of the world's population. An informed people, with skills in using its information, is a creative, problem-solving people. In a sense, mankind is involved in a race between expanding education on the one hand, and threatened disaster, perhaps oblivion and annihilation, on the other (Guilford, 1967a).

Education has generally been rather successful in transmitting to younger generations the accomplishments of the older generations, but the methods are usually quite authoritarian and oriented toward the acquisition of facts. Although these methods are effective in transmitting the facts, they give the younger generation neither instruction in how to use the information in creative ways, nor, in many cases, even the opportunity to do so. Creative education, on the other hand, aims at a self-starting, resourceful, and confident person, ready to face both personal and cognitive problems. The school seems to be a likely agency for playing a substantial role in the development of creative potential. Smith (1966) contends:

> Because of the importance of creativity in the world today, and because of its importance to the self-realization of all individuals, a re-examination of the methodology and curriculum of the . . . school is warranted. If it is the aim of the public school to develop all aspects of the intellect of the child, each ability calls for certain kinds of practice. . . . [T]here has been an imbalance of teaching in our schools toward convergent thinking, and very little toward divergent thinking, the components of which develop creative people (p. 58).

The Problem

The purpose of this research is to evaluate the componential training effects of a series of 28 audio tapes and printed exercises which were designed to develop children's abilities in the divergent thinking functions of originality, flexibility, fluency, and elaboration, and to facilitate their learning of language skills. Previous research (Bahlke, 1967) indicated that these training materials did facilitate the learning of language skills, as measured by a language achievement test as well as originality in thinking. In particular, the study will seek to evaluate the main components of the training system, which are the presentation of an idea about creative thinking, stories about pioneers, and divergent thinking exercises. Each audio tape consists of a three-to five-minute presentation of some principle or idea for improving creative thinking and an eight-to ten-minute dramatized story of an American pioneer. The tape is followed by a series of printed creativity exercises. The evaluation will attempt to measure the effectiveness of each component in improving children's divergent thinking abilities. Thus, the design is of the type described by Lumsdaine (1963) as a "diagnostic experimental evaluation."

The research is designed to answer the following questions:

1. Do each of the components of the instructional package contribute to the growth of the creative thinking abilities and to language achievement?

2. Do any combinations of the components produce an effect which is significantly different from that produced by any other component or combination of these components?

3. Are there differential effects on the amount learned from the components or combinations of the components of the creativity training programs because of sex or grade level?

4. Are there any interactions among the factors of treatment conditions, sex, and grade level which result in differential performance on the criterion tests?

5. Is there a significant relationship between the teachers' ratings of the children's creative thinking ability and the children's performance on the criterion creative thinking tests?

6. Is there a significant relationship between the teacher's and the children's levels of creative thinking ability?

Two major problems in curriculum evaluation and creativity training procedures are reproducibility or specification of the training procedures and specification of the component effects of the instructional procedures. Most training procedures are difficult to describe accurately and unequivocally because they are dependent upon subjective application by a teacher who may not be trained for the teaching task involved, especially in the area of creativity. The teacher may be required to establish a permissive climate, a playful approach, or a questioning attitude, but the researcher may be unable to provide a concrete method for her to use to accomplish these. Furthermore, if one teacher manages to approximate any of these approaches in a planned teaching procedure, her approach may still be operationally unique, unlike that of other approaches used by other teachers. Thus, in brief, training procedures which depend strongly on teacher ability and judgment are not likely to be adequately described, well validated, or reproducible.

The second problem emerges from the first. If a training procedure can be reproduced on two or more occasions, or if several teachers can replicate the performance, it probably consists of several differentiable parts, and cannot be considered a unidimensional instructional program. There may be short verbal presentations of the principles involved, brief lectures of factual material, practice exercises, and feedback techniques as well as other methods included in the instructional program. Thus it becomes very difficult to know how much, if anything, each part contributed to the overall effect of the materials which may result from their use. It is conceivable that only one portion of the instructional program produced all of the effect which was detected. Perhaps one component of the materials nullified the effect of another component and a conclusion is drawn that the system is ineffective. Here such a conclusion would be erroneous, since although the materials may be globally ineffective, certain components may contribute to learning, and would do so with modifications that would remove those components which were negatively effective.

Background of the Problem

Previous research indicated that some creative or divergent thinking abilities are capable of being developed. Maltzman (1960) reviewed his own and the research of others and concluded that originality could be developed. He suggested that fundamentally the tasks are to find a way to cause some originality in behavior to occur and then to find a way to encourage or reinforce it when it occurs.

Torrance (1964) reviewed the research on creativity instruction and concluded that there are numerous ways for teaching or developing creative or divergent thinking. However, in a review of the use of instructional media for the teaching of creativity, as reported at the Sixth Utah Creativity Research Conference, Taylor (1966) asserted that little is known about the effects of various components of the instructional media in teaching creativity. In a summary of this conference, Williams (1966) suggested that research is particularly needed on the effects of single versus multiple sensory stimulation, the effects of directions and practice, and the use of subject matter content as the vehicle for developing creative thinking.

Two new methods of utilizing instructional media in the teaching of creativity were reported recently. Crutchfield (1966) developed autoinstructional training programs which were designed to facilitate creative problem-solving abilities at the fifth- and sixth-grade levels. He reported that the programs were highly effective in improving children's ability to generate original ideas. Torrance and Gupta (1964) developed a series of twelve audio tapes and exercises designed to develop creative thinking. They reported that the tapes and exercises were effective in increasing children's ability for fluency, flexibility, originality, and elaboration in thinking.

Bahlke (1967) studied the effects of taped dramatizations and written exercises stressing creativity on creative abilities among upper elementary school children. The experimental group listened to 28 fifteen-minute radio broadcasts on creative thinking. The materials were essentially the same as those being used in the present research. A comparable control group did not have the opportunity to participate in the radio series. At the conclusion of the programs, both groups received creativity tests and achievement tests. The results indicated that the series was effective in increasing children's ability for originality in thinking.

Lumsdaine (1963) suggested that experimental evaluation of media or techniques of instruction may be "overall" or "diagnostic" or both. That is, the researcher may be interested in the global effect of various components of the media on these abilities. Thus, in a sense, the independent variables may be treated as single or multiple. For the user of the media a global assessment of the effect of the instructional "package" may provide sufficient information for selection purposes. However, the "diagnostic" or componential evaluation seems particularly appropriate when a certain package has proved to be effective globally and more information about the componential variables is desired. Gagné (1962) has warned that the effects of component variables in a training system are not always as predicted. That is, variables interact and potentially augment or reduce the effect of one another when they operate together. Thus, it is necessary to evaluate not only the contribution of each component of a training system, but also the several potential combinations of the components. This research is designed to evaluate both the single components and several combinations of the components as the total instructional unit.

Theoretical Framework of This Research

Creativity may be defined in terms of the person, the process, or the product. For the purposes of the current research, the definitions will be limited to those emphasizing the process, with reference to the products only in terms of the criterion tests used to measure the process.

Torrance (1962) suggests that creativity

> . . . is a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and the like; identifying the difficulty; searching for solutions, making guesses or formulating hypotheses and perhaps modifying and later retesting them; and finally, communicating the results.

Guilford (1967b) regards thinking abilities as intellectual skills that are trainable, by analogy to psychomotor skills. The intellectual skills involved in creative production or creative performance consist of specific as well as generalized intellectual abilities. They have been developed largely by informal practice, but they should be improvable by virtue of formal practice. These intellectual abilities often called the divergent thinking abilities, of fluency, flexibility, originality, and elaboration, fit into the "structure of intellect" model. The various kinds of fluency include ideational fluency (divergent production of semantic units), word fluency (divergent production of symbolic units), associational fluency (divergent production of relations or the production of a variety of things related in a specified way to a given thing), and expressional fluency (divergent production of systems, such as generating sentences whose words begin with the letters w, c, b, d). Flexibility is concerned with the divergent production of classes and transformations. Spontaneous flexibility has to do with the divergent production of classes. The two types of adaptive flexibility have to do with the divergent production of figural transformations and the divergent production of semantic material. The latter includes originality, where there must be a shifting of meanings. Elaboration involves the ability to produce a variety of implications from given information.

Thus the creative process is a dynamic process and one which is essential to the development of the fully functioning individual. Most researchers (e.g. Torrance, 1962; Torrance and Gupta, 1964; Guilford, 1967) agree that all children are born with some creative potential although there are individual differences here as there are in all abilities and traits.

Creativity occurs at all ages, and in all fields of human endeavor. It is developmental and its growth depends largely on the environment in which it is placed (Torrance, 1965), and the conditions, both educational and environmental, which nurture it or thwart it (Torrance, 1962; Smith, 1966).

Original or nonconforming ideas are often targets for peer pressure. Here the schools can do much to lighten these peer pressures that inhibit creative development. Presently the convergent thinking abilities are emphasized and valued in the schools. Guilford (1967b) points out that convergent thinking abilities are stressed at the expense of the divergent thinking abilities. Torrance (1962) asserts that creative thinking is a special intellectual ability that may be enhanced by training and by placing value on it, much like the convergent abilities are now stressed. Much of his work has dealt with the training of these thought processes, as well as overcoming the societal and emotional blocks.

An assumption basic to this research is that the creative abilities are amenable to development by means of planned educational experiences. This assumption is borne out by the research of Torrance (1962), Torrance and Gupta (1964), Maltzman (1960), Covington and Crutchfield (1965), and Bahlke (1967). Concomitantly, the definition of creativity as a dynamic process is in line with the assumption that the creative thinking abilities can be enhanced. Thus, the creative thinking abilities are regarded as intellectual skills, which are both general and specific.

Since every person has some degree of creative potential, the term development connotes the enhancement of some skill or ability that is already present. Generally the terms training and teaching have been used interchangeably with development in reports of research dealing with the enhancement of the creative abilities.

Significance of the Study

Development of the creative thinking abilities is of importance for psychologists as well as educators. With skill in the divergent thinking abilities, children will be capable of devising unique solutions to personal problems which would probably make for better personal adjustment. Tolerance of ambiguity, suspended judgment, and an abundance of ideas, attributes of the creative thinker, are important processes for optimum functioning within a rapidly changing society. By searching for implications rather than dwelling on the obvious, a better future can be built by improving on the past rather than just perpetuating it.

More specific outcomes of this study include: opportunity for the pupils to use a kind of thinking ability that probably has been little used; nonspecific transfer to language achievement; and knowledge of the effect of each of the components of the instructional materials upon creative thinking. Guilford (1967b) asserts that the development of divergent thinking abilities are generally neglected in the schools today. However, he contends that these abilities are important in the development of the fully functioning person. The instructional materials in the present study provide the pupils with an opportunity to practice these divergent thinking skills. In a previous study using these materials, it was found that the children who used these materials grew more in creative thinking abilities as well as language achievement than did those pupils who did not use the materials. Thus, it is expected that the pupils using the instructional materials in the present study will make greater gains in language achievement when they are compared to pupils who did not use the materials.

Another important outcome of this research is the knowledge of the functioning of the components of the instructional materials. A basic premise of this research is that creative thinking abilities can be developed. However, little is known about the effect of specific parts of certain instructional materials upon the creative thinking abilities (Taylor, 1966). Thus, the present study will provide insights into the effects of certain types of instructional materials upon the development of the creative thinking abilities. This type of information is useful both for the researcher and the educator. The researcher will have empirical evidence available as a basis for the revision of the instructional materials, and the educator will be able to select educational materials with some knowledge of the effects of those materials upon the abilities of the pupils.

CHAPTER II

THEORY AND RESEARCH

Interest in creativity, or genius or giftedness, has been evident throughout the history of psychology, but it was not until Galton's studies of men of genius in 1869 that much systematic and scientific interest was turned to this phenomenon. Galton was more concerned with the hereditary factors than with the mental processes involved in creativity. However, in fields such as science and literature, great discoveries were noted, and the people who made these discoveries were held to be models for others. From the studies of these creative people, a list of the stages of thinking that a creator typically exhibits in the creative process was formed by Wallas (1926). His list included preparation, incubation, illumination, and verification.

The period of preparation is characterized by such activities as defining the problem, gathering data and material, and choosing a plan of action. Conscious work on the problem is begun and continued as far as possible. The problem may be redefined, unworkable ideas may be discarded or reworked, and the methods re-evaluated. At some point the individual may find his attempts at problem-solving frustrated and may set the problem aside for the time being. This leads to a period called incubation.

During incubation it has been suggested that the unconscious mind takes over and continues working on the problem in some way that is not yet understood. This unconscious working of the problem leads to the third stage, illumination.

Illumination is the moment of insight. The necessary solution is suddenly realized. It can happen in many ways and under many circumstances, often several months after the problem was put aside. The illumination may be accompanied by strong feelings of exuberance.

The final stage is the period of verification during which the illumination is tested to determine whether or not the problem has really been solved.

There have been some attempts to discover whether these processes could be identified experimentally. Patrick (1941) found that they could be identified experimentally, but that they did not necessarily appear in the order Wallas hypothesized.

Since the Wallas list was postulated, many extensions and revisions of steps in the creative process have been suggested. Some of these theoretical percepts are oriented toward the person and the personality, such as those postulated by Rogers (1959) and Maslow (1959). Other theories are concerned with the product and its evaluation in relation to society. Taylor's (1959) and Eisner's (1965) conceptions of types and levels of creativity are representative of this kind of theory. Still others are concerned with the mental processes involved, such as Guilford's (1959) "structure of intellect" model. Another closely related area of concern is the training of these thought processes, or the enhancement of the creative abilities. Torrance and others have done research in this area by investigating the effects of various materials and techniques of instruction on the creative abilities of the child.

The Creative Personality

According to Rogers, there are three aspects to the creative process: the product must be something observable, it must be of novel construction, and it can appear in any field. The basis for historical evaluation is that the product must be something acceptable to some group at some time in history. The motivation for the creative act is in all men. It is man's urge to be self-actualizing, to become his potentialities.

Rogers (1959) hypothesizes several inner conditions necessary for the making of a creative product. Openness is essential to the creative act. A person must be receptive to stimuli from the environment and must be able to search out the implications rather than just dealing with the obvious facts. The source of evaluation of the created product is internal. It must be satisfying to the creator. To be creative, a person must be able to tolerate ambiguity, suspend judgment, toy with ideas, and rearrange concepts in new and different ways. He must seek hidden meanings, postulate new relationships, and focus upon the possibilities. The external social conditions for creative production are those which foster individuality and permit independent thought. The person must be accepted as of unconditional worth so that he feels no fear of criticism. Thus the person feels valued so that he can be whatever he is with no shame, and can therefore express himself as he sees fit.

Another facilitating condition is the provision of a climate in which there is no external evaluation. Evaluation is generally a threatening condition, and for the individual to be free of this threat is enormously freeing and satisfying. The source of evaluation should be internal. The absence of evaluation does not mean the absence of reaction. A person can say that he does not like a painting or a poem as a reaction and not as an evaluation. An evaluation implies the application of some external criterion where the product is judged by this standard to be good or bad.

These conditions provide the psychological freedom that is necessary for the making of a creative product. Psychological safety is brought about by an empathetic understanding of the individual, and acceptance of him from this point of view. Thus the conditions of psychological safety and psychological freedom are the facilitating conditions of creativity.

Maslow's conceptions of creativity follow much the same line as do those of Rogers. Maslow (1959) hypothesized three kinds of creativity: self-actualizing creativity, special talent creativity, and integrated creativity. The first is quite directly connected with the personality, and appears as creative flexibility and free energy to accomplish the ordinary affairs of life in a more creative way. The potentiality for this type of creativity is present in all people at birth, although it is often, by the time of later childhood, stifled by environmental conditions. Special talent creativity is associated with the idea that some people are born with unusual creative ability or "creative genius," or have high abilities in certain fields, while most people have no such high or creative abilities.

Special talent creativeness is relatively independent of mental health, while self-actualizing creativity is an effect of positive mental health. Maslow asserts that self-actualizing creative people are less fearful of other people and less fearful of themselves. They are more self-accepting and this makes it possible for them to perceive and accept reality to a greater degree.

Maslow suggests that the third type , integrated creativity, is comprised of primary and secondary creativity. Primary creativity proceeds from and uses the primary mental abilities, while secondary creativity involves the consolidation of other people's ideas. Integrated creativity stresses the personality rather than the achievement.

Types of Creativity

Some researchers have postulated various types or levels of creativity as a function of the product involved. The schema of Taylor and Eisner are examples of this work.

Taylor (1959) hypothesizes five levels of creativity. The first and lowest level is expressive creativity, which may be evidenced in the spontaneous drawings of children. It involves independent expression where skills, originality, and the quality of the product are unimportant. A more mature mastery of the environment characterizes the second level, productive creativity. Here, heightened realism, objectivity, and completeness of the product are evident. The third level, inventive creativity, entails new ways of looking at old things. There are new applications of basic ideas rather than new basic ideas. It is at this level that most inventions occur.

Innovative creativity, the fourth level, requires an understanding of the basic principles and a significant modification of them. Adler's and Jung's modifications of Freud's works are examples of this level. The highest level, emergentive creativity, involves the creation of entirely new principles or assumptions.

A unique taxonomic conceptualization of creative thinking was proposed by Eisner (1965). Four major processes or types of thinking may be demonstrated: (1) "boundary pushing" which is merely extending uses of the known into new realms; (2) "inventing" which is using known materials or ideas to create something new; (3) "boundary breaking" which is detecting gaps in current theories and developing new premises; and (4) "aesthetic organizing" which is the ability to create new ideas or products with a high degree of coherence and harmony. In a study with sixth-grade children Eisner found "boundary pushing," "inventing," and "aesthetic organizing" to be abilities which were displayed by all subjects, but "boundary breaking" was a relatively rarely displayed ability. The divergent thinking factors of spontaneous and adaptive flexibility described by Guilford (1959) are probably closely related to the functions of boundary pushing and inventing.

Creativity as Intellectual Abilities

Guilford's (1967b) "structure of intellect" describes a multidimensional model of intelligence. The many factors of intellect can be classified in three ways: content, operations, and products. The first classification is the content of thought, upon which the operations are performed. This includes figural, symbolic, semantic, and behavioral classifications. The second classification is the kind of operation that is performed upon the thought material. These include cognition, or the discovery abilities, memory, divergent and convergent production, and evaluation. The third classification specifies the resulting product. This category includes: units, classes, relations, systems, transformations, and implications. In the "structure of intellect" Guilford describes the relationship between intelligence and creativity in terms of the mental abilities involved in the production of a creative product. The mental ability involved in divergent thinking is defined as producing a quantity of ideas based upon given information. Fluency, flexibility, elaboration, and originality are included in his definition of creativity. Creative thought is also defined as going beyond divergent thinking, and includes redefinition abilities, sensitivity to problems, and tolerance of ambiguity. Transformations are also important in creative production, for they are a kind of flexibility. Transformation abilities are especially important in creative problem solving for through these abilities a person is able to alter his stored information to fit the situation at hand.

Torrance (1962) is interested in the conditions and methodologies which foster the growth and development of the special intellectual abilities which bring about creative activity. He defines creativity as the process of "sensing gaps or disturbing, missing elements; forming ideas or hypotheses concerning them; testing these hypotheses, and communicating the results, perhaps modifying and retesting the hypotheses."

He postulated some social-emotional aspects in the development of creativity which may hinder the expression of the special intellectual abilities. He suggests that at certain ages, societal and peer pressures become so great that five-year-olds lose much of their curiosity and excitement about learning, that nine-year-olds give up many of their creative activities in response to their concern about conforming to peer pressures, and that twelve-year-olds become quite commonplace in their thinking, and therefore safe, in response to even greater peer pressures.

Torrance asserts that creative thinking is a special intellectual ability that may be enhanced by training, and by placing value in it. Much of his work has dealt with the training of these thought processes, as well as overcoming the societal and emotional blocks. Some of his work is reported in more detail later in this chapter.

Guilford (1967b) concurs with Torrance's contention that the creative abilities can be increased through appropriate kinds of training. He points out that, in terms of the "structure of intellect" model, the special intellectual abilities present in memory, cognition, and convergent thinking processes are stressed in the schools today. These special intellectual abilities can be developed through the educational process, as evidenced by success in school. Thus, by analogy, the special intellectual abilities present in creative thinking should be educable.

Gallagher (1964) reviewed changes in thinking about the development of the cognitive processes and productive thinking, and pointed to increasing and expanding concerns in the area. Early researchers suggested that intelligence tests measured the important aspects of the development of the intellectual processes. Based upon this research, creativity was considered to be an important aspect of maturation and intelligence, a contention that is held by some researchers today. A second notion was that the intellectual processes were an aspect of maturation, and only extreme external conditions could change their course. A third idea was the mental abilities could not be altered because they were genetically determined, such as the constancy of the IQ which was first suggested by Darwin (1859, in Hunt, 1961).

Recent research has changed and modified these ideas. Intellectual powers are now thought to be multidimensional, rather than unitary factors, and now most psychologists consider the development of intellectual talent to be modifiable through training (Binet, 1909, in Hunt, 1961). These revisions came about as a result of a new trend of thought based upon much empirical research by such men as Hunt and Binet: the recognition that there was only limited validity to the idea of the constancy of the IQ, for as Hunt (1961) states,

> . . . it might be feasible to discover ways to govern the environment, especially during the early years of their development, to achieve a substantially faster rate of intellectual development and a substantially higher adult level of intellectual capacity (p. 363);

development of specific aptitude areas; and the recognition of the limitations of the measuring instruments used to determine IQ scores.

From this review of the various theoretical positions, it becomes evident that creativity can be defined in terms of the person, the process, and the product. Creative people were studied to determine the attributes of the creative person. Based upon these attributes, several processes exhibited in creative thinking were postulated. Another area of research interest was the categorization of the resulting product into types of products and levels of creative production. The third mode of definition, the process, is concerned with the manner in which creative production occurs, and the means by which these processes are stimulated. The present research is based upon the premise that the creative abilities, as special intellectual abilities, can be increased or strengthened through certain training or practice activities, whose potencies are as yet not fully understood. With this premise in mind, we will now turn to a review of empirical research utilizing various instructional materials and methods.

Review of Research

> It is now a known fact that nearly all of us can become more creative, if we will. And this very fact may well be the hope of the world. By becoming more creative we can lead brighter lives, and can live better with each other. By becoming more creative we can provide better goods and services to each other, to the result of a higher and higher standard of living. By becoming more creative we may even find a way to bring permanent peace to all the world. (Osborn, 1963)

There have been many studies evaluating programs for teaching students to improve their sensitivity, fluency, flexibility, originality, elaboration, and related abilities. These investigations range from the retarded level to the gifted level, and from the first grade through college and adult education. Studies of adults have involved subjects from such diverse groups as military officers, teachers, and industrial personnel. Most of the studies indicate that subjects' creative-productive levels are significantly increased by deliberate educational programs. Thus, Torrance and Gupta (1964) concluded:

> . . . the weight of the evidence seems to indicate that planned, guided experiences in creative thinking facilitates growth . . . and tend not to interfere with the usual kinds of achievement. However, much depends upon how the teachers use the materials.

Length of Time in Training

Research seems to support the logical expectation that length of training affects the strength of the results (Parnes and Brunelle, 1967). For example, a group of related studies tested the effects of short practice experiences involving the production of different word associations in response to a given word. Maltzman (1960) initiated this kind of study. He concluded that "originality is a learned form of behavior which does not differ in principle from other forms of operant behavior." In most Maltzman-type studies, gains through specific practice were found to carry over to similar criterion tests. That is, subjects practiced making associations to given words, and were then given a test list of different words and asked to make associations. In many studies of this type, training did not transfer to subsequent creativity tests.

Several studies using variable time intervals have employed programed-instructional materials developed by Crutchfield and Covington (1965). In one study, Ripple and Dacey (1967) used ten of the lessons in a time span of ten days. They found no gains in verbal creativity, although there were gains in certain behavioral problem-solving abilities, as measured by the Maier two-string problem. Another study utilizing all sixteen of the lessons on sixteen consecutive school days was done by Treffinger (1969). He found no gains in problem-solving ability and creativity as measured by Torrance's verbal creativity tests, but he did note that the pupils who had received the instructional materials attained significantly greater scores than did the control pupils on measures of attitude toward problem-solving. A third study utilizing a greater time span was that of Olton and Crutchfield (1969), who used all sixteen lessons over a time span of eight weeks. Their results indicated marked superiority for the instructed pupils on several criterion measures. Thus, these results support the contention that length of time, or spaced practice, facilitates the enhancement of problem-solving and creative abilities, a contention that also holds true for other types of verbal learning (Underwood, 1961).

Many different instructional techniques have been employed in attempts to develop the creative potential of children. A brief review of specific studies pertinent to this issue will be presented here, and will serve two purposes: to illustrate the great variation among methods and designs, and secondly to support the contention that creative potential can be developed.

Lectures about Creative Processes

True (1957) studied the effects of a fifty-minute lecture on creativity using two hundred college freshmen as subjects and a comparable control group. Both groups were given a battery of creativity tests. The results indicated that the training had a positive effect on the quantity and quality of creative productions. The degree of improvement was directly proportional to the initial creative ability.

Forehand and Libby (1962) found that exercises in creative thinking alone were not significantly effective in terms of innovative behavior later, but that exercises combined with instruction about the nature of creative thinking were effective in producing gains in creative thinking abilities. From these studies we may thus conclude that when students are taught principles of creative thinking, they are able to implement some of these principles in increasing their own creative abilities.

Problem-Solving Courses

Meadow and Parnes (1959) evaluated the effects of a creative problem-solving course on creative abilities and selected personality variables. Their subjects were college students. The results showed that (a) the experimental group, as compared to the control group, attained significantly greater increments on three of the five measures of quality of ideas; (b) the experimental group made significantly greater gains on the two measures of quantity of ideas; and (c) the experimental group made significantly greater gains on the *California Psychological Inventory Dominance* scale.

Parnes (1961) studied the effects of creativity training in a creative problem-solving course at the university level. Early in the course the experimental group was taught deferred judgment. This principle alone accounted for 72% better creative productivity. In a comparison between the experimental group that took the course, and a control group that did not, the former showed significantly greater gains on two tests of quantity of production, and on three tests of quality of production. Three personality variables were also measured: dominance, self-control, and need for achievement. The variable dominance was significantly higher in the experimental group than in the control group. The dominance scale measured such things as confidence, self-reliance, and initiative and leadership potential. Thus, we may conclude that problem-solving courses do in fact increase the subjects' abilities to perform in this area, as evidenced by the scores on the criterion tests.

Special Instructional Materials

Torrance and Gupta (1964) studied the effects of taped dramatized stories with fourth graders. At the beginning of the school term and before the experimental material was introduced, three creativity measures and an inventory were administered. After the use of the experimental materials, a series of creativity tests and an achievement battery were administered. The experimental materials consisted of a series of taped dramas followed by work sheets encouraging creative activity. One of the primary purposes of this study was to assess the effectiveness of the use of materials designed to stimulate creativity in reversing the slump in creative behavior which occurs about the fourth grade. The findings indicated that the control group showed losses on certain measures of creative thinking, while the experimental group showed significant gains on some of the measures. The control group gained on a few of the measures, but the total gains were far greater in the experimental group. Although some of the control teachers deliberately tried to stimulate creativity, and some of the experimental teachers misused the materials, the results indicated that the experimental techniques were effective.

Bahlke (1967) studied the effects of taped, dramatized stories and written exercises stressing creativity in enhancing the creative abilities of upper elementary school children. The experimental group listened to twenty-eight, fifteen-minute radio broadcasts on creative thinking. Each program consisted of a short discussion of a principle for creative thinking, a dramatized story about an American pioneer, and an introduction to the exercises. The exercises were designed to provide an opportunity for practice in ideational fluency, flexibility, and originality. Some practice on nonverbal elaboration occurred in an occasional elaborative drawing. A comparable control group did not have the opportunity to participate in the radio series. At the conclusion of the programs, both groups were given creativity tests and achievement tests. The results indicated that the experimental group made gains on verbal and nonverbal originality and language achievement.

Programed instruction has also been used as a means of increasing creative problem-solving abilities. Crutchfield and Covington (1965) have developed a set of sixteen units which were designed to develop a number of skills, complex abilities, and attitudes which are independent of the traditional subject matter content, but which should lead to positive transfer to problem tasks. In a preliminary research version of these materials, Crutchfield and Covington (1965) found that the instructed pupils were superior to the uninstructed pupils on several problem-solving criterion tasks. A second study was performed using all sixteen of the lessons, and it was again found that the instructed pupils made significant gains. It was also noted that the fifth graders outperformed the sixth grade pupils on the criterion tasks.

Olton, Wardrop, Covington, Goodwin, Crutchfield, Klausmeier, and Ronda (1967) report less striking gains when these same instructional materials are used with fifth grade pupils. However, the programs were administered four a week for four weeks, without teacher involvement. The authors suggest that greater gains could be obtained if a longer period of time had been allowed between the lessons, and if the teacher had actively participated in the program. This contention is also supported by research done by Treffinger (1969) who noted that in using the lessons in a relatively short period of time, only the pupils' attitudes toward problem-solving were significantly changed. From these studies we may conclude that it is possible to teach children to be creative. However, replications of such studies with better control is necessary in order to determine the specific effects of each of the components of the instructional materials.

There are numerous other methods that have been used as methods of developing the creative abilities of children. Most of these concentrate on ways of generating ideas and retreiving stored information.

Osborn (1963) developed a checklist procedure, a question-asking technique which ensures a wide coverage of information. Every question calls for a transformation of some kind, which may be a change in a unit of information or in some system. He suggested that because of the importance of transformation in generating new ideas, this technique, if well-directed, should be effective in increasing creative production.

Crawford's (1954) attribute listing is another method of training for creativity. In using this method, the subject thinks of specifications, limitations, and needs. He then lists attributes of the object, and changes them one by one, until he comes up with a product that fulfills his needs.

A similar method was advocated by Allen (1962) who suggests analyzing the problem in terms of the fundamental dimensions or parameters, and applying these dimensions to a model, such as Guilford's "structure of intellect" model. Then various categories are combined, with each combination bringing about a unique product. Then the question becomes one of evaluation of the feasibility and usefulness of the resulting product.

Another method suggested by Osborn (1963) was that of brainstorming where the interpersonal stimulation of a group generates a series of ideas, with one person's idea often acting as the springboard for contributions from others. However, the personalities of the participants are an important consideration here, for one dominant person may limit the scope of the work by continually forcing his ideas and train of thought upon the group.

Maltzman, Simon, Raskin, and Licht (1960) used associative training for originality in a study in which they attempted to teach college students to be more original by training them to produce unusual and remote responses to word-association tasks. They contended that giving uncommon responses was a habit that could be reinforced. They used lists of twenty-five words, and the subjects in the experimental group responded to the list several times, each time being instructed not to repeat a response that they had already given. The results indicated that the experimental group was superior to the control group in generating unusual responses at the end of the training period. There were also some gains in the experimental groups on the Unusual Uses test.

Teacher Motivation and Attitudes

Torrance (1965) studied the effects of rewarding creative behavior in the classroom. One hundred fourteen teachers were given a manual on creative behavior which suggested ways for teachers to respond to children in order to encourage creativity. The teachers were also asked to keep track of the way they responded to creative behavior. A discouragingly large number of teachers seemed unable to incorporate these ideas into their classrooms. The results showed that a slight majority of the teachers showed respect for unusual ideas and questions. Ninety percent were successful in relating evaluation to causes and consequences. Some teachers reported long-range effects such as increased interest on the part of the class, improved insight or judgment, and a decreased fear of asking questions. However, more than one-third reported no long-range effect.

In another study, Torrance (1965) found that gains in creativity depend in part on the high creative motivation of the teacher. In other words, the high creative motivated teacher was able to motivate her class to more creative behavior by means of her acceptance of such behavior in the classroom. In one of the studies on this subject, he used pupils in twenty elementary school classes. Creative thinking tests were administered to the children in January and in May. The teachers were rated as high or low creative, according to the Personal-Social Motivation Inventory. The results showed a significant gain in creativity at the kindergarten and primary level, and a gain, although not significant, at the intermediate level, for the pupils of the high creative-motivated teachers.

In a second teacher motivation study, Torrance used elementary school children. The pupils wrote an imaginative story in February and again in May. The stories were rated for organization, psychological insight, and richness. The teachers were rated as in the first study. The results showed that pupils in the classes of the high creative motivated teachers made significant gains in creativity. Pupils in the low creative motivated teachers' classes showed slight, although insignificant, losses.

An in-service program was conducted by Treffinger, Ripple, and Dacey (1968) in which an attempt was made to improve teachers' attitudes about creative problem-solving on the premise that this would help the teachers to aid their pupils in realizing their creative potential.

Attitude surveys were administered before and after the program. The results indicated that such programs significantly changed the attitudes of the teachers toward creative problem-solving abilities, and contributed to the teachers' understanding of creativity and creative pupils.

Weber (1968) suggests that the indirect behavior of the teacher influences the verbal creative potentialities of the pupils, especially in the lower elementary grades, and that the more directive the behavior, in terms of the Flanders system, the more repressed the verbal expression will be. Conversely, directive behavior on the part of the teacher (in terms of the Flanders system) more greatly enhances the nonverbal creative expressions.

"Creative Set"

Brown (1964, 1965) did two studies on the teaching of creativity by inducing a creative set. The subjects were college juniors in elementary education. They used creativity symbols to produce a creative frame of reference, and then took creativity tests using this creative frame of reference. A part of the experimental group used a non-creative symbol and took the creativity tests under the conventional conditions. The results indicated that creative production could be increased by using a creative frame of reference.

Wallach and Kogan (1965) in a study of testing atmosphere and creativity, found that in a situation that was relatively unstructured and free from anxiety, pupils performed better on the creativity tests than under the conventional testing conditions.

Thus we may conclude that a person's set, or motivation while taking the tests does influence his scores on the creativity tests. For this reason it seems important to maintain a constant level of motivation, or set, across treatment conditions in order to reliably measure the effects of the treatment rather than the effects of testing alone.

From these studies we can conclude that the attitudes, motivation, and style of teaching behavior are important factors in helping the child to realize his creative potential. Therefore it would seem that teacher behavior is an important factor in any creativity training program and should not be disregarded or left to chance.

Facilitating Conditions

In addition to developing instructional materials and desirable teacher behaviors, another factor to be considered is the condition of the classroom. Hilgard (1959) states that

> The conditions for creativity will have to be carefully nourished if we want more creativity to be demonstrated. All of our evidence shows that we must keep search alive, and we must allow sensitivity to new ideas, perhaps tolerating a little foolishness....We must not insist upon conformity or we will end with traditionalists rather than innovators. (p. 179-180)

Smith (1966) postulates five conditions that must be favorable in order for creativity to develop. These include the intellectual, physical, social-emotional, psychological, and educational conditions in the classroom.

In setting the intellectual conditions in the classroom, there should be opportunities and resources for much knowledge and skills, since the divergent thinking functions require a solid foundation of knowledge and facts upon which to operate. Specific teaching activities might include such things as open-end learning activities and teaching specific skills needed for divergent production.

The optimum conditions might be to have the classroom as a workshop with an abundance of materials. Facilitative social-emotional conditions would include the teacher's rewarding creative achievement, being sensitive to the needs of the pupils, and stressing and praising differences among the pupils. Proper psychological conditions include a permissive atmosphere based on certain underlying securities, and quite importantly, the proper attitude of the teacher. The fifth condition, the educational conditions, are best enhanced by the creative teaching methods of the teacher.

Present Research

The present research is based upon the premise that creative thinking abilities are special intellectual abilities and as such are amenable to change through training, a contention supported by Guilford and Torrance. There has been much research done in the area of developing the creative thinking abilities and of evaluation of the various programs and techniques used in this training. However, the contributions of the specific components of the various methods have not been assessed, although Forehand and Libby (1962) did find that lectures about creativity by themselves were not effective in producing gains in creative thinking abilities. Both Torrance and Bahlke have found that a combination of taped, dramatized stories and specially designed exercises did in fact increase the creative thinking abilities of the pupils who used these materials. However, it is not known just what part of the "package" was most facilitative of the creative thinking abilities, or whether it was some as yet uncontrolled variable such as teacher attitude or participation. The present research is addressed to a componential evaluation of an instructional package designed to facilitate creative thinking abilities: presentations about the creative thinking processes, a dramatized story about an American pioneer (factual material upon which to operate), and specially designed exercises which provide practice in the divergent thinking functions of fluency, flexibility, originality, and elaboration. Information will also be secured about the interactions of the various components of the instructional package with each other.

Summary

Creativity or giftedness has been of interest to researchers since the latter part of the nineteenth century. Creative people were studied in an attempt to learn something about the processes involved in creative production. Some early research in the area was that done by Wallas (1926) who postulated four processes exhibited in the creative process: Preparation, incubation, illumination, and verification. Since this list was postulated, many extensions and revisions have been suggested. Some of these are oriented toward the person and the personality, such as those theories developed by Rogers (1959) and Maslow (1959). Others are concerned with the product and its evaluation in relation to society. Taylor's (1959) and Eisner's (1965) conceptions of types and levels of creativity are representative of this type of theory. Still others are concerned with the mental processes involved, such as Guilford's (1959) "structure of intellect." Another closely related area of concern is the training of these thought processes.

Both Guilford (1967b) and Torrance (1964) assert that the creative thinking abilities are special intellectual abilities, and as such, are amenable to training.

There has been much research in the area of the development and evaluation of techniques and materials designed to stimulate creative thinking abilities. These materials have included such things as presentations about the creative thinking processes, problem-solving courses, taped, dramatized stories and special exercises, programed instruction, and special techniques such as checklists, attribute listing, brainstorming, and associative training. Some of the materials produced the desired effects, while others fell short. Many times there was little or no transfer to subsequent creativity tests. Often there were gains when some combination of treatments was used, such as taped, dramatized stories and exercises. Thus the contribution of specific parts of the materials was unknown.

Since much of the training took place in the classroom, there has been some concern about the teacher's motivation and attitude toward creativity. Generally it was found that teachers whose attitudes were favorable toward creativity and who had high creative motivation, had more creative pupils than those teachers whose attitudes and motivation about creativity were low (Torrance, 1965).

Optimum conditions for the expression of creativity include a workshop-like atmosphere where unusual ideas are valued and the proper attitude of the teacher is present.

Thus we may conclude that there are optimum materials, techniques, and conditions for training the creative thinking abilities. However, comparative and componential evaluations of these instructional materials are required before conclusions can be made as to which are the "best" methods for stimulating the creative thinking abilities.

CHAPTER III

PROCEDURES AND DESIGN

This chapter will report the sampling techniques, the instructional materials, the procedures, and will review the specific questions being posed and the hypotheses designed to answer those questions. Data will be reported concerning the reliability and validity of the measuring instruments used, and the formal design of the analysis will be set forth.

Sample

From a population of approximately one hundred fourth, fifth, and sixth grade classes in an urban school system, fifty-four classes, eighteen at each grade level, were randomly selected and assigned to one of nine treatment conditions. There were six classes, two at each grade level, in each treatment group. The breakdown of the sample size of the treatment conditions by grade and by sex is reported in Table 1.

Instructional Materials and Treatment Conditions

The instructional materials evaluated consisted of twenty-eight audio tapes and a set of three or four

Table 1

Breakdown of Sample
(including only those with complete data)

Treatment Condition	Fourth Grade		Fifth Grade		Sixth Grade		Total
	Boys	Girls	Boys	Girls	Boys	Girls	
1	34	20	16	26	17	15	128
2	22	15	25	25	28	20	135
3	25	32	28	26	17	25	153
4	29	16	26	18	23	23	135
5	26	24	22	30	20	27	149
6	25	29	20	13	16	29	132
7	29	21	28	15	21	25	139
8	16	11	19	22	33	24	125
9	25	18	30	28	24	28	153
	231	186	214	203	199	216	1249

Totals

Boys	644
Girls	605
Fourth Grade	417
Fifth Grade	417
Sixth Grade	415
Grand Total	1249

exercises for each tape. The program consisted of three parts: (1) a three- to four-minute presentation designed to teach a principle or idea for improving creative thinking; (2) an eight- to ten-minute story about a famous American pioneer; and (3) a set of exercises. The exercises for each program consisted of printed directions, problems, or questions which were designed to provide practice in the divergent thinking functions of originality, flexibility, fluency, and elaboration. The elements of the programs evaluated were thus: (1) the presentations of ideas or principles for improving creative thinking, (2) the stories of American pioneers, and (3) the printed exercises.

Each of the three parts was presented separately, in pairs, and all together for a total of seven experimental arrangements. In addition, two control groups were used: one group which received both the pretest and the posttest, and another group which received the posttest only. Thus, the nine basic arrangements for experimental evaluation were as follows:

1. Presentations about creativity
2. Stories of pioneers
3. Printed exercises
4. Presentations plus stories
5. Presentations plus exercises
6. Stories plus exercises

7. Presentations plus stories plus exercises
8. No treatment-pretest and posttest
9. No treatment-posttest only

Thus, according to Campbell and Stanley (1963), the design is a modification of the pretest-posttest control group design in that a second posttest-only control group was added to increase the external validity. The design takes the form:

$$\begin{array}{llll} R & O_1 & X & O_2 \\ R & O_3 & & O_4 \\ R & & & O_5 \end{array}$$

R = random assignment
O = observation (test)
X = treatments

Specifically, with a control group lacking the pretest, the effect of testing may be determined by comparing the pretested and the posttest-only control groups. One can also determine the effect of maturation and history by comparing O_5 with O_1 and O_3.

Procedures

Prior to the beginning of the use of the experimental instructional materials, the Minnesota Tests of Creative Thinking (MTCT) were administered to all experimental groups and to the pretested control group as the pretest. The instructional materials were administered by the classroom teacher twice a week for fourteen weeks. Those treatment conditions which used the exercises returned these exercises to the researcher at the end of each two-week period. These exercises were marked "Try harder," "Good, but try harder," "Very good," and "Excellent," and then returned to the children. The purpose in stamping the exercises was to reinforce fluency and elaboration. At the conclusion of the series of twenty-eight programs, the Torrance Tests of Creative Thinking, Form A, (TTCT: Torrance, 1966) were administered as the posttest to all experimental groups and to both control groups. The MTCT is an earlier, research edition of the TTCT, Form B, and is thus comparable to the Form A which was administered as the posttest. Data were also gathered concerning the teachers' and pupils' evaluation of the material, and a rating by the teacher for the overall creative ability of each of the pupils in her class was obtained. The teachers were given descriptions of creative behavior and were asked to place the pupils in their class into a five category, forced-normal distribution (See Appendix I). The TTCT, Form A, was also administered to all participating teachers. In addition, the IQ, age, and grades from the previous year were obtained for each child from the school records. The Iowa Tests of Basic Skills (ITBS) were administered by the school system approximately one month after the posttest. These scores were also obtained.

Instruments

Creativity Tests

The Minnesota Tests of Creative Thinking, Abbreviated Research Edition VII, (Torrance, 1962) used as the pretest are composed of four tasks: two nonverbal - figure completion and circles, and two verbal - product improvement (toy dog) and unusual uses for tin cans. Each nonverbal task is scored for four dimensions: fluency, flexibility, originality, and elaboration; the verbal tasks are scored for fluency, flexibility, and originality. Seven scores were used in the analyses: the totals of the two nonverbal tasks for each dimension, and the totals of the two verbal tasks for each dimension.

The Torrance Tests of Creative Thinking, Research Edition, Verbal and Figural Forms A (Torrance, 1966) are parallel forms with the MTCT. Selected tasks from these tests were used as the posttest. The four tasks selected were: figure completion, parallel lines, product improvement (toy elephant), and unusual uses for cardboard boxes. They were selected in order to ensure comparability to the tasks in the MTCT. Reliability and validity coefficients are reported below for these subtests. For the present purpose of assessing growth in creative thinking abilities, it was concluded that these tasks would adequately measure growth in creative thinking abilities.

Also, the length of a total battery of creativity tests (one verbal and one figural set of tasks) seemed prohibitive because of the time involved in administration and the relatively short attention span of young children.

Description of the Scoring Dimensions. Each task is scored for four different dimensions: fluency, flexibility, originality, and elaboration. Fluency is the total number of relevant responses, relevancy being defined in terms of the requirements of the tasks as set forth in the instructions. Flexibility is the number of different principles or approaches used in responding to the task. Originality is the rareness or uniqueness of ideas expressed. Scores of 0, 1, and 2 are given depending upon the unusualness of the response. Elaboration is the number of details used to elaborate the main idea over and above what is necessary to communicate the basic idea. However, for nonverbal elaboration, the maximum possible is two points per response.

Description of the Tasks. The two verbal tasks included product improvement and unusual uses for common objects. The product improvement tasks call for the production of clever, interesting, and unusual ways of changing a toy stuffed animal (dog for MTCT, elephant for TTCT) so that it would be more fun for children to play with. The unusual uses tasks call for the production of interesting and unusual uses for common objects, such as tin cans for MTCT and cardboard boxes for the TTCT.

Two figural or nonverbal tasks were also used: the figure completion and the repeated figures. The stimulus material for the figure completion task consists of ten incomplete figures. The children are instructed to add lines to the figures to sketch some interesting objects and pictures. They are encouraged to think of things that no one else will. The repeated figures task consists of two or three pages of circles (MTCT) or pairs of parallel lines (TTCT). The instructions are much the same as those for the figure completion task. Again, the children are encouraged to produce things which no one else will think of.

Reliability. Table 2 presents the test-retest reliability coefficients of these seven scores over a five month period, with parallel forms of the test. These data are from the pretested control group only, since the programs received by the experimental group probably created differences in scores in these groups on the posttest, and would thus contribute error to the estimate of reliability.

Over the three grade levels, the coefficients range from .31 to .64. Within the various grade levels, the range is from .02 to .65. A differential effect due to grade was noted, with the fourth and fifth grades being nearly equivalent, and the sixth grade slightly lower. However, for the purpose of the present research, the obtained coefficients were felt to be adequate.

Table 2

Test-Retest Reliability over Five Months

Category	Fourth Grade	Fifth Grade	Sixth Grade	All Grades
Nonverbal Fluency	.60	.55	.41	.46
Nonverbal Flexibility	.43	.27	.36	.31
Nonverbal Originality	.20	.52	.13	.41
Nonverbal Elaboration	.63	.47	.42	.42
Verbal Fluency	.65	.59	.49	.64
Verbal Flexibility	.60	.63	.47	.64
Verbal Originality	.44	.34	.02	.35

Table 3 summarizes the means and standard deviations of each scorer for all tasks on ten MTCT tests, and presents the coefficients of interscorer reliability (Pearson product-moment) based on a sample of ten tests. The coefficients ranged from .99 to .71, with most being in the .80's and .90's. Scorer 3 scored only nonverbal tasks; hence only nonverbal data is reported for this scorer. The majority of the scoring was done by scorers two and four. In light of the amount of work done by these two

Table 3

Means and Standard Deviations for 10 Sample Tests with Coefficients of Interrater Reliability

	Scorer 1		Scorer 2		Scorer 3		Scorer 4	
Tasks	Mean	SD	Mean	SD	Mean	SD	Mean	SD
NV Flu	20.10	7.52	20.40	7.40	20.50	7.42	20.30	7.48
NV Flex	12.80	4.59	13.00	4.81	13.20	4.23	12.70	4.99
NV Orig	12.80	5.41	15.70	6.16	16.70	6.57	13.90	6.42
NV Elab	26.30	11.18	25.30	8.23	32.60	12.58	26.10	8.37
V Flu	10.50	7.44	9.60	7.26			8.20	6.84
V Flex	5.30	2.79	5.50	2.84			4.50	2.84
V Orig	7.60	6.38	7.40	7.69			6.00	5.66

Coefficients of Reliability

Nonverbal Fluency (NV Flu)

Scorer	2	3	4
1	.9980	.9977	.9984
2		.9991	.9992
3			.9984

Nonverbal Flexibility (NV Flex)

Scorer	2	3	4
1	.9215	.9449	.9965
2		.9327	.9264
3			.9595

Table 3 (cont'd)

Coefficients of Reliability (cont'd)

Nonverbal Originality (NV Orig)

Scorer	2	3	4
1	.9504	.7110	.9716
2		.7468	.9789
3			.7240

Nonverbal Elaboration (NV Elab)

Scorer	2	3	4
1	.9520	.9920	.9974
2		.9778	.9586
3			.9945

Verbal Fluency (V Flu)

Scorer	2	4
1	.9603	.9423
2		.9900

Verbal Flexibility (V Flex)

Scorer	2	4
1	.8206	.9328
2		.8897

Verbal Originality (V Orig)

Scorer	2	4
1	.9206	.9358
2		.9117

scorers, and their relatively high reliability coefficients, the reliability of the scoring was felt to be adequate.

The studies of test-retest reliability of the Torrance tests have rather consistently indicated that reliabilities are higher for adults than for younger children. Research has indicated that the reliabilities, as well as validity coefficients, are greatly influenced by the motivational factors in the testing situation. This is perhaps more critical in this kind of testing than in personality, intelligence, and achievement testing, since the subject must produce constructed responses, and this requires more expenditure of energy than the mere selection of responses in the multiple-choice format. Consistent motivation is perhaps easier to maintain in older than in younger subjects. Experience has indicated that with good motivation and careful testing, especially in individual testing, it is possible to obtain high test-retest reliability even with mentally retarded children. This is reflected in the work of Rouse (1965) who obtained test-retest reliabilities of .85, .76, and .68 on the fluency, flexibility, and originality scores of alternate forms of the product improvement tasks with thirty-one mentally retarded children over six months.

Wodtke (1963) calculated the test-retest reliabilities of the Torrance tests with an elapsed time of six months. He found a differential effect of grade, and reported reliabilities for the nonverbal total scores of .46, .34, .61, and .64 for the second, third, fourth, and fifth grades respectively. For the verbal scores, he reported coefficients of .61 and .75 for the fourth and fifth grades respectively. For the totals from the scoring categories, he reported the following data from the fourth and fifth grades:

	Fourth Grade	Fifth Grade
Nonverbal Fluency	.56	.63
Nonverbal Flexibility	.33	.40
Nonverbal Originality	.59	.59
Nonverbal Elaboration	.53	.45
Verbal Fluency	.56	.79
Verbal Flexibility	.50	.61
Verbal Originality	.35	.58

Torrance (1966) reported reliability coefficients in the upper .40's to upper .60's with elementary school pupils. He found fairly high test-retest reliabilities with college students over a three month period: .68 to .85 for the subtests and .88 for the total score.

Goralski (1964) obtained test-retest reliabilities of .82, .78, .59, and .83 for student teachers with a ten week interval on fluency, flexibility, originality, and total battery. Sommers (1961) obtained test-retest reliability coefficients for battery totals of .97 and .80 for two different samples of college students tested with a ten-week interval. Yamamoto (1962) obtained test-retest reliabilities of .79 on fluency for twenty-two college students with a ten-week interval. He also obtained coefficients of .75, .60, and .64 for fluency, flexibility, and originality on the unusual uses for tin cans tasks, and coefficients of .69, .64, and .61 for the same dimensions for the product improvement tasks. On the circles task, he obtained reliabilities of .76, .63, and .79 on these same three dimensions.

Mackler (1962) in a triple testing situation, obtained reliabilities on the unusual uses task of .61, .62, and .71 for fluency, flexibility, and originality between the first and second testings; .75, .74, and .66 between the second and third testings; and .65, .71, and .60 between the first and third testings. On the circles task in the same triple testing situation and with the same three dimensions, he obtained reliability coefficients of .72, .60, and .63 between the first and second testings; .65, .62, and .81 between the second and third testings; and .47, .60, and .57 between the first and third testings.

Grover (1963) tested 101 ninth graders with an elapsed time of one week, and obtained test-retest reliabilities of .69 for the total circles score. Treffinger (1969) calculated the test-retest reliability coefficients for the verbal tasks with an elapsed time of three weeks. For the product improvement task he obtained reliabilities of .61, .59, .61, and .34 for the fourth, fifth, sixth, and seventh grades respectively, and for the unusual uses task obtained reliabilities of .36, .31, .60, and .46 for the fourth, fifth, sixth, and seventh grades respectively. Thus, from the reports of the reliability of the Torrance tests, we may conclude that they are adequate for research purposes in measuring any growth resulting from the experimental procedures.

Validity. Since a person can behave creatively in an almost infinite number of ways, it is not surprising that investigators have used a variety of approaches in attempting to establish the validity of the tests.

Torrance based his arguments for validity of the TTCT on the studies that come within the framework of his definition of creativity as a process through which difficulties, gaps in information, and incongruities are sensed, and resolution of the resulting tension is sought through questioning, searching for additional information and new relationships, guessing or hypothesizing, testing these hypotheses, correcting them, and communicating the results. He bases his arguments for content validity on his efforts to base test stimuli, the test tasks, and scoring procedures on the best theory and research now available. Analyses of the lives of indisputably creative people, the nature of performances widely regarded as creative, and research and theory concerning the functioning of the human mind have been considered in making decisions in the selection of the test tasks.

In the general purpose batteries, an attempt has been made to keep the test tasks free of technical or subject matter content. The tasks in these batteries can be administered from kindergarten through graduate school. This makes it possible to determine whether children and young people identified as "creative" behave in ways similar to the ways eminent people of the past behaved when they were children and young people. One can also determine whether adults identified as creative today, on the basis of outside criteria, behave in creative ways on the basis of test scores.

One special type of construct validity evidence that seems appropriate to the measurement of the creative thinking abilities are studies of the growth of creative abilities resulting from the exercise of these abilities through participating in creative activities of various kinds. Some of these experiments involved the creation of motivating conditions that apparently facilitated the functioning of these abilities. From these studies there is evidence that practice in creative writing outside of the curriculum, participating in a seminar on perceptual awareness, participation in creative activities, unevaluated practice, potentiality evaluation rather than deficiency evaluation, and the like all contribute to the development of the abilities assessed by the TTCT.

Some studies have engaged students in creative thinking activities as an integral part of traditional courses. These studies have involved children of varying ages and ability levels. For example, Cartledge and Krauser (1963) reported a study involving first grade children who were given practice on creative thinking exercises and Rouse (1965) reported a study involving mentally retarded children. Both of them found statistically significant growth in excess of that shown by control subjects on TTCT tasks of product improvement, incomplete figures, and picture construction for Cartledge and Krauser, and on product improvement and circles for Rouse. Yee (1964) reported a study involving creative problem-solving instruction to twelfth grade students with growth assessed by means of the TTCT. He also found that the experimental students at all levels of ability made gains.

Enochs (1964) attempted to produce creative growth among fifth grade children by changing the behavior of teachers. Through the use of audio-video replay method of changing teacher attitudes and behavior, the experimental teachers accepted an increasing percentage of pupils' ideas as the experiment progressed while the control teachers did not. The pupils of the experimental teachers showed greater gains than those of the control teachers on the TTCT, especially on originality.

Weisberg and Springer (1961) found that gifted preadolescents identified by the tests as creative, compared with their equally gifted (as measured by tests of intelligence) peers were rated significantly higher in: strength of self-image, ease of early recall, humor, self-awareness, uneven ego development, unconventional responses, fanciful and imaginative treatment of inkblots, independence from environmental influences, and readiness to respond emotionally to the environment.

Generally there have been few studies in the area of concurrent validity because of the problems involved in criterion construction. Clark (1964) and Hamburg (1964) have studied the area of creative thinking ability and preferred ways of learning. Although the relationships were not usually high, there were in these studies indications that highly creative children prefer open-structured rather than closed structured learning experiences more frequently than do their less creative peers. The least creative children were less productive in open tasks, and the most creative ones reacted less favorably to closed tasks.

Predictive validity studies take several years to carry out, and there are not many completed at the present time. One study involving forty-four University (Minnesota) High School seniors was done by Erickson (1966). These seniors, many of them highly gifted, were administered the TTCT in the fall of 1961 and followed up to ascertain their creative achievements in the winter and spring of 1966.

Although a large proportion of these young people were either still in graduate school or in military service, they reported an impressive array of creative achievement. Using an index derived from the number of types of creative achievements reported, Erickson obtained the product-moment correlations with the creative thinking measures as follows: fluency, .27; flexibility, .24; elaboration, .16; and originality, .17. In spite of the relatively low correlation, originality scores predicted successfully at better than the .05 level the following twelve kinds of checklist behavior thought to be associated with creative achievement: writing a story, song, or play; writing a book; handling in-service training for co-workers; learning a new language; subscribing to professional journals; suggesting modification of existing policies which were adopted by superiors and/or co-workers; receiving a grant for original research; having a scientific or scholarly paper published in a professional or scientific journal; being elected to a student office; giving a public recital;

performing on radio or TV; and developing an original experimental design in research. Most of these achievements were also predicted at the .05 level of significance by the total or composite creative thinking score.

From the reports on the validity of the Torrance tests, we may conclude that they probably do measure what they purport to measure: the creative abilities when these abilities are considered to be special intellectual abilities. Because of the similar definition of the creative thinking abilities in the present research, these tests are considered valid for the purpose of measuring growth in the creative thinking abilities due to the experimental procedures.

Reliability of Teacher Ratings of Pupil Creativity

In several studies by Torrance (1962, 1963), Yamamoto (1962), and Torrance and Myers (1962), at or above the fourth grade level, pupils nominated by teachers as most fluent, flexible, original, and elaborative in their thinking and those nominated as the lowest have been differentiated by appropriate scores on the TTCT. Torrance and Gupta (1964) found that fourth grade teachers were able to differentiate fluency, flexibility, and originality in their students. Thus, with an adequate description of the creative behaviors, teachers are able to rate the creative abilities of their students with some degree of reliability. These studies also give further evidence for the construct validity of the tests, as well as the adequacy of teacher ratings.

Iowa Tests of Basic Skills

The Iowa Tests of Basic Skills (ITBS) are designed to measure educational growth in certain specific skills involved in learning activities. The ITBS contain five separate tests: (1) Vocabulary, (2) Reading and Comprehension, (3) Language Skills (spelling, capitalization, puncuation, and usage), (4) Work-Study Skills (map-reading, graphs and tables, reference materials), and (5) Arithmetic Skills (arithemtic concepts and problem solving). The content of each test emphasizes use of knowledge rather than rote memory.

Reliability. Split-half reliability estimates adjusted by the Spearman-Brown Prophecy Formula, ranged from .89 to .92 for the separate tests within the battery (excluding subtest scores) and from .97 to .98 for the composite score. These estimates were based in a sample of approximately 12.5 percent of the answer sheets completed by the standardization group at each grade level. The sample sizes ranged from N = 2497 (Grade 8) to N = 2803 (Grade 4). Equivalent-form reliability data estimates ranged from .81 (Work- Study Skills, Grade 3) to .94 (Language Skills, Grades 5, 6, and 7). The relatively high intercorrelations among the five separate tests at each grade level suggest that the skills measured by the ITBS tend to be rather homogeneous from test to test.

Validity. Evidence of the power of the ITBS Composite Scores obtained in Grade 8 to predict the grades of a sample of freshmen entering college is reported in the *Manual for Administrators, Supervisors, and Counselors*. These validity estimates, corrected for restriction in range, varied from .65 to .93. Thus the tests were able to predict, with some degree of accuracy, the grades of the students four years later. In light of the evidence, these tests appear to be of sufficient reliability and validity for use in the present research.

Research Questions and Hypotheses

With the foregoing descriptions of the various treatments in mind, the following research questions are posed:

1. Do each of the components of the instructional package contribute to the growth of the creative thinking abilities and to language achievement?

2. Do any of the components produce an effect which is significantly different from that produced by any other component or combination of these components?

3. Are there differential effects on the amount learned from the components or combinations of the components of the creativity training programs because of sex or grade level?

4. Are there any interactions among the factors of treatment conditions, sex, and grade level which result in differential performance on the criterion tests?

5. Is there a significant relationship between the teachers' ratings of the children's creative thinking ability and the children's performance on the criterion creative thinking tests?

6. Is there a significant relationship between the teacher's and the children's levels of creative thinking ability?

In order to answer these questions and to guide research, the following hypotheses were postulated, and served as guides in making judgments related to the results. These hypotheses are as follows:

Hypothesis I: The components of the instructional package will contribute equal amounts to the growth of creative thinking abilities and to language achievement.

Hypothesis II: No two combinations of the components of the instructional package will produce a significantly different amount of growth of the creative thinking abilities than that produced by any other two parts or by the three parts together.

Hypothesis III: There will be no differential effects because of sex or grade level on the amount learned from the components or combinations of the components of the creativity training programs.

Hypothesis IV: There will be no significant interactions among the factors of treatment conditions, sex, and grade level which will result in differential performance on the criterion tests.

Hypothesis V: There will be no relationship between the teachers' ratings of the children's creative thinking ability and the children's performance on the creative thinking tests.

Hypothesis VI: There will be no relationship between the teacher's and the children's levels of creative thinking ability.

Statistical Analyses

Campbell and Stanley (1963) state that covariance analyses with the pretest scores as the covariates are usually preferable to simple gain score comparisons in measuring the amount of growth or gain since the pretest and the posttest are usually highly related. Thus, on the basis of logical considerations, the creativity pretest scores will be used as the covariates for the comparable posttest scores, and preliminary correlations will determine whether IQ and language achievement scores should also be used as covariates. However, in order to obtain empirical support for these logical assumptions, correlations between the dependent variables (posttest scores) and independent variables (IQ and pretest scores) will be computed. The decision as to which covariates to use will include consideration of the magnitude of these relationships. Thus, if any correlation is not significant, the use of that variable as a covariate would not add any power to the results. Where covariance is used, appropriate analyses will be run to ascertain the linearity of regression, an assumption that must be met to use covariance analyses (Gourlay, 1953 and Lord, 1960).

In the statistical evaluation of the treatment conditions, two sets of analyses will be conducted: one with the class mean as the unit of observation, and one with the score of each child as the unit of observation. Since the children sat in the classroom and received the instructional materials at the same time, it may be argued that the class mean in the appropriate unit of analysis (Lindquist, 1940).

However, Fletcher (1968) asserts that individual scores should be the units of analysis since one wants to generalize to a population of individuals rather than to a population of class means. He points out that even though the children sat as a group through the experimental conditions, each child probably learned something a bit different from every other child from the instructional materials. Therefore he suggests using the individual scores in the analysis.

A three-factor factorial analysis of covariance will be used, with the various combinations of the components of the instructional package, presentations, stories, and exercises, accounting for the eight levels of the treatment factor, grade, with three levels, and sex, with two levels. The pretest scores will be used as covariates in assessing the amount of change or growth resulting from the components of the instructional materials. If warranted by preliminary computations, IQ and language achievement scores will be added as covariates. This set of analyses will provide tests for hypotheses II, III, and IV.

Similar analyses will be run with the addition of language achievements scores as a dependent variable. The same preliminary considerations will be used in determining what covariates should be included. These analyses will provide a test for hypothesis I.

Preliminary tests on the complete analysis of covariance model will determine how the F ratios will be computed. If the preliminary tests on the model so indicate, the interaction terms will be pooled into the error term to provide a more rigorous test (Winer, 1963).

Figure 1 sets forth the complete model; preliminary tests and the final model will be reported in Chapter IV.

To test hypothesis V, correlations will be run between the pupils' standardized total posttest scores, verbal and nonverbal, and teacher's rating of their creative ability. Thus there will be two correlations: one between the standardized nonverbal posttest scores and the teacher's rating, and one between the standardized verbal posttest scores and the teacher's rating. Hypothesis VI will be tested using a canonical correlation (Winer, 1963; Cooley and Lohnes, 1962) between the teacher's scores on the tests of creative thinking, and the average scores for her class on the posttest.

Source of Variation	df	E(MS)
A	p-1	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma} + nq\sigma^2_{\alpha\gamma} + nr\sigma^2_{\alpha\beta} + nqr\sigma^2_{\alpha}$
B	q-1	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma} + np\sigma^2_{\beta\gamma} + nr\alpha^2_{\alpha\beta} + npr\sigma^2_{\beta}$
C	r-1	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma} + np\sigma^2_{\beta\gamma} + nq\sigma^2_{\alpha\gamma} + npq\sigma^2_{\gamma}$
AB	(p-1)(q-1)	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma} + nr\sigma^2_{\alpha\beta}$
AC	(p-1)(r-1)	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma} + nq\sigma^2_{\alpha\gamma}$
BC	(q-1)(r-1)	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma} + np\sigma^2_{\beta\gamma}$
ABC	(p-1)(r-1)(q-1)	$\sigma^2_{\varepsilon} + n\sigma^2_{\alpha\beta\gamma}$
Within cell	pqr(n-1)	σ^2_{ε}

Figure 1. Complete Analysis of Variance Model. (Winer, 1963)

CHAPTER IV

RESULTS

Preliminary tests on the analysis of variance model were run and it was determined that the three factor interaction term should be pooled into the error term to provide a more rigorous test. The revised model appears in Figure 2. All F tests were made using the pooled error term, which is indicated on the analysis of covariance tables.

Correlations were run between all pairs of variables to determine which variables should be included as covariates in the analyses of covariance. The complete correlation matrix is reported in Table 4. In order for a variable to be included as a covariate in a particular analysis, it must have correlated at least .19 ($p < .05$, $n = 100$) with the variate. Thus, it was determined empirically that the pretest variable should be the covariate for the corresponding posttest variable, supporting the logical considerations of covariance analysis as a measure of growth. In addition, IQ and language achievement total score were also used as covariates for the verbal creativity scores. A fourth covariate,

Effect	df	E(MS)
A	p-1	$\sigma_{\varepsilon}^{2} + nq\sigma_{\alpha\gamma}^{2} + nr\sigma_{\alpha\beta}^{2} + nqr\sigma_{\alpha}^{2}$
B	q-1	$\sigma_{\varepsilon}^{2} + np\sigma^{2} + nr\sigma_{\alpha\beta}^{2} + npr\sigma_{\beta}^{2}$
C	r-1	$\sigma_{\varepsilon}^{2} + np\sigma_{\beta\gamma}^{2} + nq\sigma_{\alpha\gamma}^{2} + npq\sigma_{\gamma}^{2}$
AB	(p-1)(q-1)	$\sigma_{\varepsilon}^{2} + nr\sigma_{\alpha\beta}^{2}$
AC	(p-1)(r-1)	$\sigma_{\varepsilon}^{2} + nq\sigma_{\alpha\gamma}^{2}$
BC	(q-1)(r-1)	$\sigma_{\varepsilon}^{2} + np\sigma_{\beta\gamma}^{2}$
Residual	(p-1)(q-1)(r-1)+prq(n-1)	σ_{ε}^{2}

Figure 2. Revised Analysis of Variance Model. (Winer, 1963)

Table 4

Correlation Matrix for All Variables

			Pretest							Posttest								
		IQ	NVFLU	NVFLX	NVO	NVE	VFLU	VFLX	VO	NVFLU	NVFLX	NVO	NVE	VFLU	VFLX	VO	LU	LT
	IQ		-.01	.11	.18	.06	.33	.35	.28	-.01	.09	.06	.10	.27	.35	.23	.65	.71
Pretest	NVFLU			.58	.52	.84	.24	.09	.17	.39	.32	.29	.20	.17	.09	.05	-.05	-.03
	NVFLX				.55	.54	.26	.21	.22	.31	.34	.30	.19	.21	.21	.14	.07	.12
	NVO					.57	.33	.25	.33	.26	.25	.32	.19	.23	.19	.16	.12	.15
	NVE						.26	.14	.22	.35	.31	.28	.22	.20	.15	.12	.04	.07
	VFLU							.67	.78	.21	.22	.24	.17	.51	.42	.34	.32	.34
	VFLX								.63	.08	.16	.19	.10	.36	.46	.35	.37	.38
	VO									.16	.16	.23	.13	.37	.37	.34	.27	.27
Posttest	NVFLU										.77	.68	.59	.36	.18	.19	-.07	-.04
	NVFLX											.67	.48	.35	.27	.20	.06	.09
	NVO												.51	.35	.24	.30	.02	.04
	NVE													.29	.20	.24	.05	.07
	VFLU														.64	.59	.23	.27
	VFLX															.64	.35	.37
	VO																.24	.25
	LU																	.88

language usage, was included for the variables of verbal flexibility and verbal originality. All means and standard deviations used in the post hoc tests have been adjusted for the appropriate covariates.

The results will be presented in several main sections, corresponding to the scoring categories on the creativity tests, the language achievement test, the teacher creativity tests, the teacher ratings of pupil creativity, and the control group comparisons. For each of the scoring categories on the creativity test, with the exception of elaboration, the nonverbal and verbal total scores will be presented, not the separate task scores. For elaboration, only the nonverbal total scores will be presented since verbal elaboration was not scored. For the creativity variables and the language achievement scores, analyses of covariance, and adjusted means and standard deviations were calculated. Newman-Keuls tests were run to test the significance of differences among means when three or more means were compared simultaneously. Results using the individual scores as the unit of analysis will be reported first for each variable, followed by parallel analyses using the class mean as the unit of analysis. In order for an F ratio to be considered significant, the .05 level of significance must have been attained. When a main effect is involved in an interaction, that main effect will not be analyzed further.

A canonical correlation was run using the scores from the teachers' creativity tests and the pupils' creativity tests, and will be presented in the section on teacher creativity tests. For the teacher ratings of pupil creativity, simple correlation coefficients were computed between the nonverbal grand total and the teacher rating; thus two coefficients will be presented. The control group comparisons consist of a series of analyses of variance with the groups being the pretest from the control group, the posttest from the pretested control group, and the posttest from the posttest-only control group.

Nonverbal Fluency

The results for nonverbal fluency are presented first. For the individual scores, the F ratios of the interactions of sex by treatment, 2.76 (7 and 1061 df) and grade by treatment, 4.58 (14 and 1061 df) were significant as reported in Table 5. The means and standard deviations, adjusted for pretest nonverbal fluency, are also reported in this table. Newman-Keuls tests were run on these interactions, and the results of these tests are reported in the table of means. The number in parentheses below a particular mean indicates other means from which it significantly differs at that grade level.

Table 5

Nonverbal Fluency

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	48.42	1.21	1	0.08	.01
Grade (B)	2	117.59	2.93	2	3.89	.73
Treatment (C)	7	130.92	3.26**	7	13.87	2.62*
A X B	2	43.08	1.07	2	2.26	.42
A X C	7	110.58	2.76**	7	7.74	1.460
B X C	14	183.81	4.58**	14	17.25	3.26**
Pooled error	1061	40.14		59	5.30	

**$p < .01$

* $p < .05$

Table 5 (cont'd)

Means and Standard Deviations for Individual Scores
(adjusted for pretest nonverbal fluency)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade		Boys		Girls	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	23.85 (4568)[1]	9.62	20.16 (235678)	9.64	18.85 (3456)	9.65	21.03 (358)	9.53	21.39 (28)	9.82
2	24.55 (45678)	9.62	24.06 (148)	9.63	19.99 (56)	9.62	20.58 (3568)	9.73	24.93 (1345678)	10.58
3	26.75 (1245678)	9.62	22.69 (18)	9.63	21.27 (1)	9.62	23.54 (12478)	10.13	23.74 (28)	9.47
4	20.81 (1238)	9.63	21.08 (2678)	9.63	21.25 (1)	9.65	20.53 (3568)	9.27	21.68 (28)	10.89
5	20.91 (1238)	9.65	23.78 (148)	9.62	23.15 (1278)	9.63	24.00 (12478)	10.32	21.52 (28)	9.04
6	21.66 (1238)	9.63	24.32 (148)	9.65	23.04 (1278)	9.64	22.96 (248)	9.22	22.60 (28)	9.13
7	21.83 (1238)	9.62	23.12 (148)	9.64	20.11 (56)	9.62	21.71 (358)	9.56	21.56 (28)	10.02
8	15.22 (1234567)	9.62	17.88 (1234567)	9.62	19.36 (56)	9.62	18.36 (1234567)	9.36	16.88 (1234567)	10.01

[1] The numbers in parenthesis identify the other means which are significantly different from this mean at the .05 level.

Table 5 (cont'd)

Means and Standard Deviations for Means Analysis
(adjusted)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	26.87 (8)	2.50	21.02 (6)	2.52	22.62	2.50
2	25.89	2.56	25.23	2.50	23.24	2.52
3	27.64 (8)	2.52	23.56	2.50	23.54	2.52
4	22.94	2.54	22.85	2.52	24.27	2.52
5	23.65	2.52	24.34	2.50	25.00	2.52
6	25.10	2.52	27.04 (1)	2.84	25.81	2.56
7	23.34	2.50	25.44	2.54	24.32	2.52
8	19.81 (13)	2.54	25.44	2.50	19.84	2.50

Fourth Grade

At the fourth grade, the means from all treatment conditions differed from the control condition mean of 15.22. The treatment means ranged from 20.81 for treatment 4 to 26.75 for treatment 3. Some trends were evident in the comparison of means from treatments 1 to 7. All multiple component packages, treatments 4, 5, 6, and 7, with means of 20.81, 20.91, 21.66, and 21.83 were significantly lower than the means of the single component treatment conditions, where the means were 23.85, 24.55, and 26.75 for conditions 1, 2, and 3 respectively.

Fifth Grade

All treatment conditions differed from the control at the fifth grade also. The treatment means ranged from 20.16 for condition 1 to 24.32 for condition 6 as compared to a mean of 17.88 for the control condition. Trends evident in the comparison of the treatment means 1 to 7 included methods 5, 6, and 7, with means of 23.78, 24.32, and 23.12 which significantly differed from treatments 1 and 4, with means of 20.16 and 21.08. The higher means in this comparison were all for groups which had the exercises, while the groups with the lower means did not. There were other significant differences among means, but no further pattern was discernible.

Sixth Grade

At the sixth grade level, only conditions 5 and 6, with means of 23.15 and 23.04, differed from the control mean of 19.36. Treatment 7, containing all three components, whose mean was 20.11, was significantly lower than conditions 5 and 6, and lower than condition 4, but not significantly so. Treatments 4, 5, and 6 all contain two components. No further trends were noted in the remaining differences among means, some of which were significant.

Sex

For the sex by treatment interaction, all treatment means differed from the control means for both sexes. For boys, the treatment means ranged from 20.53 for condition 4 to 24.00 for condition 5 as compared to the control mean of 18.36. For the girls, the treatment means ranged from 21.39 for condition 1 to 24.93 for condition 2, as compared with the control mean of 16.88. Although no pattern of significant differences among means was noted for the boys, a pattern did emerge for the girls: all treatment means as well as the control mean were significantly lower than the mean from treatment 2, 24.93, which is a single component treatment containing stories.

Analysis of Means

For the means analysis the F ratio for the treatment by grade interaction was significant (3.26, 14 and 59 df). The adjusted means and standard deviations are also reported, as well as the significant differences among these means. At the fourth grade, conditions 1 and 3, with means of 26.87 and 27.64 differed from the control mean of 19.81. At the fifth and sixth grades, no treatment differed significantly from the control. There were no patterns of relationships for the differences among the means, so no further results will be presented.

Verbal Fluency

The analysis of covariance for verbal fluency is reported in Table 6. For the individual scores, the F ratio for the main effect of sex, 19.66 (1 and 1059 df) was significant, as was the F ratio for the treatment by grade interaction (2.92, 14 and 1059 df). The means and standard deviations, adjusted for pretest verbal fluency, IQ, and language achievement total score are also presented, along with the significant differences among those means as determined by the Newman-Keuls procedure. For the main effect of sex, the mean for the boys was 14.64, and for the girls, 16.35.

Table 6

Verbal Fluency

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	3663.86	19.66**	1	9.02	0.30
Grade (B)	2	815.98	4.38*	2	38.72	1.30
Treatment (C)	7	287.23	1.54	7	24.19	0.81
A X B	2	126.11	0.68	2	7.08	0.23
A X C	7	190.95	1.02	7	18.73	0.63
B X C	14	543.65	2.92**	14	43.16	1.45
Pooled error	1059	186.37		59	29.74	

*p < .05 **p < .01

Means and Standard Deviations for Individual Scores
(adjusted for pretest verbal fluency, IQ, language total)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	23.41 (2)	16.05	28.81 (3)	15.93	26.38 (3458)	16.13
2	29.67 (14578)	16.11	32.05 (37)	15.99	28.38 (3)	15.94
3	26.71 (58)	16.06	24.00 (1245)	16.10	33.07 (127)	16.19
4	23.22 (2)	16.23	29.52 (3)	15.99	32.57 (17)	16.04
5	21.89 (23)	16.01	30.43 (3)	16.09	32.30 (17)	15.96
6	25.65 (8)	16.05	27.73	16.38	30.89 (7)	15.99
7	23.56 (2)	16.02	27.00 (2)	15.97	25.17 (34568)	16.03
8	19.67 (236)	16.15	28.04	16.05	31.76 (17)	16.14

Fourth Grade

At the fourth grade, conditions 2, 3, and 6, with means of 29.67, 26.71, and 25.65 differed significantly from the control mean of 19.67. Although there were a number of significant differences among treatment means 1 to 7, no discernible pattern of relationships emerged.

Fifth Grade

At the fifth grade, none of the treatment means differed significantly from the control mean. There was no pattern of relationships among those treatment means which significantly differed.

Sixth Grade

Treatment means 1 and 7 (26.38 and 25.17), differed significantly from the control mean of 31.76, but here the control group was high. Treatment condition 7, which included all three components, with a mean of 25.17, was significantly lower than conditions 3, 4, 5, 6, and 8, where the means ranged from 30.89 (condition 6, stories and exercises) to 33.07 for condition 3 (exercises). There were no other patterns of relationships in the differences among the means.

Analysis of Means

In the parallel analysis using the mean as the unit of analysis, there were no significant results.

Nonverbal Flexibility

For nonverbal flexibility on the individual scores, the F ratios for treatment, 2.70 (7 and 1061 df) and sex by grade, 3.02 (2 and 1061 df) were significant as reported in Table 7. Since the interaction of sex by grade was not of interest in the present study, no post hoc tests were conducted for this interaction. The means and standard deviations, adjusted for pretest nonverbal flexibility, are also reported in this table. The treatment means which significantly differed from one another are noted.

The control mean, 13.48, differed significantly from all treatment means, which ranged from 15.59 for condition 1 to 17.64 for condition 3. Although there were other significant differences among the means, no discernible pattern emerged.

The means analysis yielded no significant results.

Verbal Flexibility

The analysis of covariance for verbal flexibility is reported in Table 8. For the individual scores, the F ratio for treatment by grade, 6.61 (14 and 1058 df), was significant. The means and standard deviations, adjusted for pretest verbal flexibility, IQ, language usage and language total achievement scores are also presented in this table. Treatment means which significantly

Table 7

Nonverbal Flexibility

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	38.64	1.92	1	0.191	0.07
Grade (B)	2	36.68	1.82	2	4.159	1.54
Treatment (C)	7	54.42	2.70**	7	4.958	1.84
A X B	2	60.75	3.02*	2	4.311	1.60
A X C	7	12.16	0.60	7	0.713	0.26
B X C	14	26.87	1.33	14	2.404	0.89
Pooled error	1061	20.14		59	2.702	

*$p < .05$ **$p < .01$

Means and Standard Deviations for Individual Scores
(adjusted for pretest nonverbal fluency)

Treatment	Mean	SD
1	15.59 (23568)	6.98
2	17.13 (134578)	7.30
3	17.64 (124678)	7.07
4	15.79 (23568)	7.17
5	17.49 (124678)	6.93
6	16.82 (134578)	6.61
7	15.84 (23568)	7.05
8	13.48 (1234567)	6.95

Table 8

Verbal Flexibility

Analysis of Covariance

Source	Individual Scores df	Individual Scores MS	Individual Scores F	Means df	Means MS	Means F
Sex (A)	1	34.34	2.13	1	0.38	.06
Grade (B)	2	33.34	2.07	2	2.58	.39
Treatment (C)	7	44.28	2.75**	7	3.24	.49
A X B	2	16.07	1.00	2	1.35	.20
A X C	7	14.57	0.90	7	1.51	.23
B X C	14	106.50	6.61**	14	6.31	.95
Pooled error	1058	16.12		59	6.65	

**p < .01

Means and Standard Deviations for Individual Scores (adjusted for pretest verbal flexibility, IQ, language usage, language total)

Treatment	Fourth Grade Mean	Fourth Grade SD	Fifth Grade Mean	Fifth Grade SD	Sixth Grade Mean	Sixth Grade SD
1	8.66 (23678)	4.93	9.50 (45)	4.88	9.64 (248)	4.96
2	13.36 (134678)	4.94	8.69 (345)	4.88	11.01 (17)	4.91
3	10.08 (12458)	4.93	10.62 (27)	4.98	10.69 (4)	5.01
4	7.15 (123567)	4.97	11.33 (12678)	4.89	11.93 (1567)	4.90
5	8.04 (234678)	4.90	11.48 (12678)	4.91	10.25 (48)	4.90
6	9.48 (2458)	4.93	9.23 (45)	5.03	10.07 (48)	4.89
7	9.30 (2458)	4.90	9.19 (345)	4.90	9.39 (248)	4.91
8	6.94 (123567)	4.94	9.81 (45)	4.92	11.84 (1567)	4.90

differ from one another, with a given grade level, as determined by the Newman-Keuls procedure, are noted.

Fourth Grade

At the fourth grade, all treatment means, ranging from 7.14 for condition 4 to 13.36 for condition 2, differed significantly from the control mean of 6.94. There were other significant differences among the means, but there was no pattern of relationships.

Fifth Grade

At the fifth grade, treatment means 4 and 5, 11.33 and 11.48, differed significantly from the control mean of 9.81. The mean from treatment 7, 9.19, was significantly lower than the means of treatments 3, 4, and 5 (10.62, 11.33, and 11.48). Although other means differed significantly from one another, no discernible pattern was evident.

Sixth Grade

Treatment means 1, 5, 6, and 7 (9.64, 10.25, 10.07, 9.39) differed significantly from the control mean of 11.84. However, here the control group mean was higher than that of the treatment conditions.

Analysis of Means

The analysis of covariance for the means yielded no significant results.

Nonverbal Originality

For nonverbal originality for the individual scores, the F ratios for sex by treatment 2.33 (7 and 1061 df) and treatment by grade, 5.22 (14 and 1061 df) were significant as reported in Table 9. The means and standard deviations, adjusted for pretest nonverbal originality, are also reported in this table. Means which significantly differ from one another within a given grade level, as determined by the Newman-Keuls procedure, are noted.

Fourth Grade

For the fourth grade, all treatment means, ranging from 20.57 for treatment 4 to 30.76 for treatment 3, differed significantly from the control means of 16.04. Treatment means 1 and 3, 25.00 and 30.76, both from single component treatments, were significantly higher than the mean from treatment 7, 21.45, which contained all the components. The remaining one-component treatment condition, treatment 2, was higher than treatment 7, but this difference was not significant.

Table 9

Nonverbal Originality

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	45.20	.58	1	0.74	.04
Grade (B)	2	204.18	2.62	2	14.94	.70
Treatment (C)	7	259.67	3.33**	7	16.92	.80
A X B	2	137.49	1.76	2	8.43	.40
A X C	7	174.18	2.23*	7	11.44	.54
B X C	14	406.92	5.22**	14	31.56	1.47
Pooled error	1061	70.03		59	21.22	

* $p < .05$

**$p < .01$

Table 9 (cont'd)
Means and Standard Deviations for Individual Scores

Treatment	Fourth Grade		Fifth Grade		Sixth Grade		Boys		Girls	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	25.00 (23478)	11.76	23.46 (678)	11.73	21.51 (25)	11.73	23.27 (38)	11.64	23.54 (28)	12.03
2	21.59 (138)	11.72	24.85 (568)	11.75	25.18 (1)	11.72	21.95 (3568)	11.88	26.85 (145678)	12.95
3	30.76 (1245678)	11.73	24.33 (568)	11.73	22.79	11.75	26.57 (12478)	12.38	25.71 (458)	11.57
4	20.57 (138)	11.72	22.99 (678)	11.73	23.77	11.72	22.04 (3568)	11.33	22.72 (238)	13.30
5	23.01 (38)	11.74	20.87 (23678)	11.76	25.32 (1)	11.74	25.25 (248)	12.62	21.36 (238)	11.05
6	22.41 (38)	11.73	27.62 (123458)	11.82	23.95	11.75	24.79 (248)	11.26	23.98 (28)	11.16
7	21.45 (138)	11.72	26.82 (1458)	11.73	22.81	11.74	23.51 (38)	11.69	23.60 (28)	12.23
8	16.04 (1234567)	11.79	18.32 (1234567)	11.73	22.52	11.72	19.46 (1234567)	11.45	18.85 (1234567)	12.23

Fifth Grade

All treatment means, ranging from 20.87 for treatment 5 to 27.62 for treatment 6, differed significantly from the control mean of 18.32. No trends among the other significant means emerged, so they will be discussed no further.

Sixth Grade

At the sixth grade level, no treatment means differed from the control mean. There were no trends among those means which did differ significantly.

Sex

Post hoc tests of the sex by treatment interaction indicated that for both sexes, all treatment means differed significantly from the control means. For the boys, the treatment means ranged from 21.95 for treatment 2 to 26.57 for treatment 3. The mean for treatment 3 (exercises), was significantly higher than the means from treatments 1, 2, 4, and 7, where the means were 23.27, 21.95, 22.04, and 23.51. Thus, those treatments which did not contain the exercises, plus the treatment with all the components, were significantly less effective than the treatment condition containing the exercises only.

For the girls, the treatment means ranged from

21.36 for treatment 5 to 26.85 for treatment 2, as compared to the control mean of 18.85. Although there were other significant differences among the treatment means, no patterns of relationships emerged.

Analysis of Means

The means analysis yielded no significant results.

Verbal Originality

The analysis of covariance for verbal originality for the individual scores is reported in Table 10. The F ratios of three interactions were significant: sex by grade, 3.63 (2 and 1058 df); sex by treatment, 2.17 (7 and 1058 df); and treatment by grade, 4.15 (14 and 1058 df). Since the sex by grade interaction was not of interest in this study, it was not analyzed further. The remaining interactions were tested using the Newman-Keuls procedure. These results are reported in the table of means and standard deviations, which have been adjusted for pretest verbal originality, IQ, language usage, and language achievement total.

Fourth Grade

At the fourth grade level, the mean from treatment 3, 12.17, was significantly greater than the control mean, 6.36. The mean from treatment 3 was also significantly

Table 10

Verbal Originality

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	137.79	1.46	1	6.13	.20
Grade (B)	2	834.11	8.85**	2	83.68	2.74
Treatment (C)	7	284.54	3.02**	7	15.41	.50
A X B	2	342.35	3.63*	2	8.69	.28
A X C	7	204.36	2.17*	7	11.46	.38
B X C	14	391.02	4.15**	14	30.83	1.01
Pooled error	1058	94.28		59	30.50	

* $p < .05$

**$p < .01$

Table 10 (cont'd)

Means and Standard Deviations for Individual Scores
(adjusted for pretest verbal originality, IQ,
language usage and language total)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade		Boys		Girls	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	7.01 (3)	9.81	10.01	9.74	7.14 (23567)	9.88	9.21	4.93	9.29	5.11
2	8.20 (3)	9.84	11.72 (67)	9.74	17.11 (134568)	9.74	10.06	5.04	11.40	5.52
3	12.17 (1248)	9.79	9.42	10.06	12.36 (1278)	9.83	10.08	5.28	10.54	4.94
4	6.91 (3)	9.86	11.87	9.74	10.34 (27)	9.74	10.15	4.80	10.12	5.66
5	8.98	9.75	12.20	9.79	12.74 (1278)	9.72	10.26	5.35	9.51	4.71
6	9.55	9.77	7.68 (245)	9.91	11.93 (127)	9.73	10.07	4.83	9.25	4.75
7	9.01	9.75	7.77 (245)	9.74	15.62 (134568)	9.77	9.45	4.97	9.14	5.18
8	6.36 (3)	9.84	10.04	9.80	8.90 (2357)	9.73	10.41	4.90	9.16	5.20

greater than the means from treatments 1, 2, and 4 (7.01, 8.20, 6.91), none of which included the exercises.

Fifth Grade

At the fifth grade, none of the treatment means differed significantly from the control mean. However, the mean from treatment 7, 7.77 was significantly lower than the means from treatments 2, 4, and 5 (11.72, 11.87, 12.20).

Sixth Grade

At the sixth grade, means from treatments 2, 3, 5, and 7 (17.11, 12.36, 12.74, 15.62) were significantly higher than the control mean, 8.90. Treatment mean 2 (stories), 17.11, was significantly greater than all other treatment conditions and the control condition.

Sex

Although the F ratio for the sex by treatment interaction was significant, post hoc tests revealed no significant differences among the means.

Analysis of Means

The means analysis yielded no significant results.

Nonverbal Elaboration

The analysis of covariance for nonverbal elaboration is reported in Table 11. For the individual scores, the F ratio for the interaction of grade by treatment, 3.94 (14 and 1061 df), was significant. The means and standard deviations, adjusted for pretest nonverbal elaboration, are reported; those treatment means which significantly differ from one another within a grade are noted.

Fourth Grade

At the fourth grade, all treatment means, ranging from 23.58 for treatment 4 to 31.93 for treatment 3, were significantly higher than the control mean, 18.92. Although there were significant differences among treatment means 1 to 7, no pattern of relationships emerged so they will not be discussed further.

Fifth Grade

For the fifth grade, all treatment means, with the exception of treatment 1, were significantly higher than the control mean, 21.55. They ranged from 27.55 for treatment 5 to 31.56 for treatment 2. Although there were other means which differed significantly from one another, no trends emerged, so they will not be discussed further.

Table 11

Nonverbal Elaboration

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	28.26	0.22	1	2.42	.09
Grade (B)	2	426.70	3.30*	2	4.30	.17
Treatment (C)	7	495.70	3.83**	7	45.84	1.79
A X B	2	8.98	0.07	2	10.13	.40
A X C	7	71.95	0.56	7	11.74	.46
B X C	14	509.34	3.94**	14	53.18	2.08*
Pooled error	1061	129.28		59	25.62	

*p < .05 **p < .01

Means and Standard Deviations for Individual Scores
(adjusted for pretest nonverbal elaboration)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	27.93 (368)	13.96	23.14 (2)	13.96	22.01 (2356)	13.98
2	27.88 (8)	14.01	31.56 (158)	14.01	29.39 (1)	13.96
3	31.93 (48)	13.95	28.20 (8)	13.94	28.56 (1)	14.01
4	23.58 (36)	13.94	28.40 (8)	13.95	26.36	13.94
5	26.54 (8)	13.96	27.55 (28)	13.94	32.09 (17)	13.98
6	30.95 (48)	13.94	28.31 (8)	14.04	30.58 (17)	13.94
7	26.00 (8)	13.98	29.04 (8)	13.94	23.91 (56)	14.00
8	18.92 (123567)	13.97	21.55 (234567)	13.95	26.62	13.95

Table 11 (cont'd)

Means and Standard Deviations for Means Analysis
(adjusted)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	32.41	5.00	24.07	5.00	24.78	4.96
2	28.56	5.20	30.52	5.06	34.08	5.00
3	33.06	5.00	29.43	4.97	29.02	5.08
4	22.83 (6)	4.96	30.84	4.99	29.38	4.96
5	29.89	4.96	28.05	4.94	33.13	5.06
6	37.05 (4)	4.96	30.64	5.32	34.20	4.98
7	26.90	5.08	32.28	4.96	25.51	5.02
8	25.14	4.98	29.49	4.96	27.74	4.96

Sixth Grade

For the sixth grade, none of the treatment means differed significantly from the control mean. However, the mean from treatment 7 (23.91), which included all three components, was significantly lower than the means for treatments 5 and 6 (32.09, 30.58), which included two components each.

Analysis of Means

For the means analysis, the F ratio for the treatment by grade interaction was significant (2.08, 14 and 59 df). Adjusted means and standard deviations are reported, with those means that differ significantly from one another at a given grade level noted. At the fourth grade the mean from treatment 6, 37.05, was significantly higher than the mean from treatment 4, 22.83. There were no other significant differences among the means at this or any other grade level.

Iowa Tests of Basic Skills

Language Usage

Two scores were used from the ITBS language achievement tests: the language usage and the language total scores. For the language usage scores in the individual scores analysis, the F ratios for the main effect of sex, 8.11 (1 and 1221 df) and the treatment by grade interaction, 5.16 (14 and 1221 df) were significant, as reported in Table 12. For the main effect of sex, the mean for the boys was 43.33, and for the girls, 49.55. The means and standard deviations, adjusted for IQ, also appear in Table 12.

Fourth Grade. Post hoc tests on the significant interaction revealed that the treatments were generally most effective at the fourth grade. Here all treatment means, except treatment 4, ranging from 41.67 for treatment 1 to 66.72 for treatment 2, were significantly greater than the control mean, 33.90. Although there were significant differences among other means, no trend was discernible.

Fifth Grade. For the fifth grade, the means from treatments 2, 3, 4, 5, and 6, ranging from 48.20 for treatment 2 to 59.98 for treatment 5 were significantly greater than the control mean, 41.01. The mean from treatment 7, 42.65, was significantly lower than the means from treatments 3, 4, 5, and 6 (54.60, 50.48, 59.98, 52.17). Condition 3 (exercises) is a single component treatment, while 4, 5, and 6 are all treatments with two components. There were other significant differences among the means, but no pattern of relationships was discernible.

Table 12

ITBS Language Usage

Analysis of Covariance

Source	Individual Scores			Means		
	df	MS	F	df	MS	F
Sex (A)	1	3383.00	8.11**	1	433.03	8.32**
Grade (B)	2	7221.92	17.32**	2	442.83	8.51**
Treatment (C)	7	1795.76	4.31**	7	162.64	3.13**
A X B	2	780.37	1.87	2	86.76	1.67
A X C	7	447.29	1.07	7	48.88	0.94
B X C	14	2149.82	5.16**	14	136.61	2.63**
Pooled error	1221	417.06		59	52.02	

**p < .01

Means and Standard Deviations for Individual Scores (adjusted for IQ)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	41.67 (234578)	25.65	45.91 (35)	25.63	49.92 (4567)	25.92
2	66.72 (1345678)	25.69	48.20 (58)	25.66	49.52 (4567)	25.62
3	49.98 (12468)	25.74	54.60 (1578)	25.65	46.11 (47)	25.71
4	32.23 (123567)	25.63	50.48 (578)	25.62	37.32 (1238)	25.62
5	53.97 (12468)	25.63	59.98 (1234678)	25.62	42.33 (127)	25.64
6	40.18 (23457)	25.63	52.17 (578)	25.65	40.68 (128)	25.62
7	50.76 (12468)	25.63	42.65 (3456)	25.63	36.79 (12358)	25.62
8	33.90 (123567)	25.81	41.01 (23456)	25.77	46.88 (467)	25.67

Table 12 (cont'd)

Means and Standard Deviations for Means Analysis (adjusted)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	48.44	7.54	52.70	7.72	42.34	7.54
2	57.55 (48)	7.86	52.90	7.54	52.42	7.56
3	50.04	7.74	56.42	7.54	42.18	7.56
4	38.95 (257)	7.54	55.77	7.56	42.48	7.62
5	58.16 (48)	7.54	55.56	7.62	45.99	7.56
6	41.73	7.56	56.48	7.54	42.90	7.54
7	58.28 (48)	7.58	47.99	7.60	43.18	7.56
8	35.43 (257)	7.64	49.47	7.72	48.78	7.62

Sixth Grade. At the sixth grade, treatment means 4, 6, and 7 (37.32, 40.68, 36.79) were significantly lower than the control mean, 46.88. Treatment mean 7 was significantly lower than means 1,2, 3, 5, and 8, where the means ranged from 42.33 for treatment 5 to 49.92 for treatment 1. The single component treatment means were higher than the multiple component treatment means, although this difference was not always significant.

Analysis of Means. In the parallel analysis using the mean as the experimental unit, the F ratios for the main effect of sex, 8.32 (1 and 59 df) and the treatment by grade interaction, 2.63 (14 and 59 df) were significant. For the main effect of sex, the mean for the boys was 46.74, and for the girls, 51.28. The adjusted means and standard deviations are reported; those means which differed significantly within a grade are noted. The post hoc tests revealed that the only means which differed significantly were at the fourth grade. Treatment means 2, 5, and 7 (57.55, 58.16, 58.28) were significantly greater than the control mean, 35.43.

Language Achievement Total

For the individual scores analysis on the ITBS language achievement total score, the F ratios for the main effect of sex, 50.29 (1 and 1221 df) and the treatment by grade interaction, 6.38 (14 and 1221 df) were significant as reported in Table 13. For the main effect of sex, the mean for the boys was 43.20, and for the girls, 53.34. The means and standard deviations, adjusted for IQ, also appear in this table.

Fourth Grade. Post hoc tests revealed that at the fourth grade, all treatment means, ranging from 40.20 for treatment 4 to 66.34 for treatment 2 were significantly greater than the control mean, 35.03. Although there were other means which significantly differed, no pattern of relationships was evident.

Fifth Grade. At the fifth grade, treatment means 2, 3, 4, 5, and 6, ranging from 49.42 for treatment 2 to 61.91 for treatment 5, were significantly greater than the control mean, 42.86. Treatment mean 7, 40.89, was significantly lower than treatment means 1, 2, 3, 4, 5, and 6, where the means ranged from 47.77 for treatment 1 to 61.91 for treatment 5.

Sixth Grade. At the sixth grade, the control mean, 48.06, was significantly higher than treatment means 4, 6, and 7 (38.32, 41.13, 37.30). The mean from treatment 7 was significantly lower than treatment means 1, 2, 3, and 5 (52.55, 51.36, 46.58, 44.31) and the control mean. In general, the means from the single component treatments were higher, although not always significantly, than the multiple component treatments.

Means Analysis. For the means analysis for this variable, the F ratios for the main effect of sex, 28.46 (1 and 59 df) and the treatment by grade interaction, 2.53 (14 and 59 df) were significant. For the main effect of sex, the mean for the boys was 46.47, and for the girls, 55.36. The adjusted means and standard deviations, as well as the analysis of covariance, appear in Table 13.

For the fourth grade, all treatment means, ranging from 46.98 for treatment 6 to 61.13 for treatment 7, were significantly higher than the control mean of 37.87. Although there were other means which differed significantly from one another, no trends emerged, so they will not be discussed further.

For the fifth grade, all treatment means with the exception of treatment 2, differed significantly from the control mean of 52.05. They ranged from 48.07 for treatment 7 to 66.20 for treatment 6. Treatment 7 was significantly lower than all other treatment conditions, as well as the control group mean. No other pattern of relationships emerged from among the other means which differed significantly.

At the sixth grade, all treatment means, ranging from 40.84 for treatment 3 to 53.96 for treatment 2, were significantly different from the control mean of 49.58. However, the control mean was significantly higher than treatment means 1, 3, 4, 5, 6, and 7. Treatment mean 7,

Table 13

ITBS Language Total

Analysis of Covariance

	Individual Scores			Means		
Source	df	MS	F	df	MS	F
Sex (A)	1	18172.57	50.29**	1	1446.44	28.46**
Grade (B)	2	8723.51	24.14**	2	468.81	9.22**
Treatment (C)	7	1038.68	2.87**	7	105.14	2.07
A X B	2	971.28	2.69	2	81.76	1.61
A X C	7	353.49	0.98	7	40.25	0.79
B X C	14	2303.58	6.38**	14	128.52	2.53**
Pooled error	1221	361.34		59	50.82	

**p < .01

Means and Standard Deviations for Means Analysis (adjusted)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	51.72 (2345678)	7.38	55.38 (2678)	7.55	43.77 (23458)	7.38
2	57.18 (134678)	7.69	53.24 (134567)	7.38	53.96 (1345678)	7.40
3	50.29 (1245678)	7.57	56.27 (2678)	7.40	40.84 (1245678)	7.40
4	47.92 (123578)	7.38	56.26 (2678)	7.40	45.80 (123678)	7.45
5	56.02 (134678)	7.38	56.17 (2678)	7.46	47.33 (123678)	7.40
6	46.98 (123578)	7.40	66.20 (1234578)	7.38	43.72 (123458)	7.40
7	61.13 (1234568)	7.43	48.07 (1234568)	7.45	44.21 (23458)	7.41
8	37.87 (1234567)	7.48	52.05 (134567)	7.53	49.58 (1234567)	7.45

Table 13 (cont'd)

Means and Standard Deviations for Individual Scores
(adjusted for IQ)

Treatment	Fourth Grade		Fifth Grade		Sixth Grade	
	Mean	SD	Mean	SD	Mean	SD
1	44.37 (23578)	25.98	47.77 (3567)	25.96	52.55 (4567)	26.25
2	66.34 (1345678)	26.02	49.42 (5678)	25.98	51.36 (4567)	25.95
3	51.51 (1248)	26.06	54.80 (15678)	25.98	46.58 (47)	26.04
4	40.20 (23578)	25.96	50.74 (5678)	25.95	38.32 (12358)	25.95
5	52.44 (12468)	25.96	61.91 (123478)	25.95	44.31 (1247)	25.97
6	45.43 (2578)	25.96	60.40 (123478)	25.98	41.13 (128)	25.95
7	51.87 (12468)	25.96	40.89 (123456)	25.96	37.30 (12358)	25.95
8	35.03 (1234567)	26.14	42.86 (23456)	26.11	48.06 (467)	26.00

44.21, was significantly lower than treatment means 2, 4, and 5 (53.96, 45.80, 47.33) and the control mean. Although other means significantly differed, no further patterns of relationships emerged.

Teacher Creativity Tests

The seven scores from the teacher creativity tests (nonverbal fluency, flexibility, originality, and elaboration and verbal fluency, flexibility, and originality) were correlated with the means for these same seven scores by means of a canonical correlation. Complete data were available for 43 teachers and therefore 43 classes were used in this analysis. The first three roots were as follows:

First root:	.6849	(49 df)
Second root:	.5790	(36 df)
Third root:	.5135	(25 df)

The results of the canonical correlation indicated that there is a substantial amount of common variance among the task scores of the creativity tests for the teacher and her students. Perhaps the commonality is due to similar performances of the teacher and her students, especially when both are exposed to the same training procedures for the creative thinking abilities.

Teacher Ratings

Correlations were run between the pupil's total verbal and nonverbal creativity scores and the teacher's rating of that child's creative ability. Thus, there were two correlation coefficients: the nonverbal total score and the teacher's rating, and the verbal total score and the teacher's rating. The nonverbal total was obtained by transforming the raw scores on nonverbal fluency, flexibility, originality, and elaboration into T scores, and then summing these scores for a composite total score. A similar procedure was followed for the verbal total, except that only verbal fluency, flexibility, and originality were used. A coefficient of .06 was obtained for nonverbal total score, and a coefficient of .22 was obtained for the verbal total score. Both were significant.

Control Group Comparisons

Table 14 presents the analyses of variance from the two control groups. Three sets of scores, the pretest and the posttest from condition 8, and the posttest from condition 9, the posttest-only control group, were compared to determine whether the pretest sensitized the children. If the pretest had such an effect, the posttest means from group 8 would exceed the posttest means from group 9. However, the means from the posttest-only control group were significantly higher than the scores from the pretested control group, and some problem in sampling seems likely. There were significant differences in all analyses except one: fifth grade nonverbal fluency.

Due to the problems in sampling for this posttest only control group, it was dropped from subsequent analyses and discussion.

Table 14

Control Group Comparisons

Nonverbal Fluency

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	1224.85	13.58**	8pre	16.94	10.01
Within	142	90.19		8post	14.88	9.90
				9post	24.60	8.38

Fifth Grade

Analysis of Variance				Means and Standard Deviation		
Source	df	MS	F	Group	Mean	SD
Between	2	300.79	2.75	8pre	16.52	8.78
Within	185	109.38		8post	18.09	12.90
				9post	20.91	9.02

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	836.01	17.01**	8pre	14.65	6.65
Within	129	49.15		8post	19.48	7.76
				9post	23.25	6.66

**p < .01

Table 14 (cont'd)

Verbal Fluency

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	912.38	23.54**	8pre	9.58	5.39
Within	142	38.75		8post	11.46	7.71
				9post	18.00	5.16

Fifth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	324.15	4.56**	8pre	11.85	9.40
Within	185	71.14		8post	12.77	8.81
				9post	16.24	6.67

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	653.71	23.27**	8pre	10.65	5.24
Within	129	28.90		8post	15.48	5.96
				9post	18.23	4.78

**$p < .01$

Table 14 (cont'd)

Nonverbal Flexibility

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	912.38	23.54**	8pre	9.58	5.39
Within	142	38.75		8post	11.46	7.71
				9post	18.00	5.16

Fifth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	324.15	4.56**	8pre	11.85	9.40
Within	185	71.14		8post	12.77	8.82
				9post	16.24	6.67

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	653.71	23.27**	8pre	10.65	5.24
Within	129	28.10		8post	15.48	5.96
				9post	18.23	4.78

$^{**}p < .01$

Table 14 (cont'd)

Verbal Flexibility

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	463.87	26.78**	8pre	4.58	3.16
Within	142	17.32		8post	4.90	4.21
				9post	10.20	5.01

Fifth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	503.54	15.84**	8pre	5.89	3.38
Within	185	31.79		8post	8.77	7.26
				9post	11.62	5.59

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	311.43	13.24**	8pre	8.90	3.96
Within	129	23.53		8post	12.90	5.13
				9post	14.00	5.23

**$p < .01$

3

Table 14 (cont'd)

Nonverbal Originality

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	3318.97	40.73**	8pre	9.66	5.42
Within	142	81.48		8post	14.60	10.80
				9post	26.07	10.02

Fifth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	2106.26	15.40**	8pre	14.31	7.60
Within	185	136.81		8post	18.75	14.29
				9post	25.96	12.25

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	3606.19	46.37**	8pre	9.48	4.48
Within	129	77.77		8post	22.32	9.48
				9post	27.04	10.62

**p < .01

Table 14 (cont'd)

Verbal Originality

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	1611.47	25.94**	8pre	6.70	5.52
Within	142	62.12		8post	3.20	4.50
				9post	14.64	11.99

Fifth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	329.46	3.41*	8pre	13.25	11.71
Within	185	96.72		8post	9.18	10.07
				9post	9.46	6.79

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	936.81	9.40**	8pre	11.98	8.72
Within	129	99.65		8post	10.70	6.63
				9post	18.98	12.66

**p < .01 *p < .05

Table 14 (cont'd)

Nonverbal Elaboration

Fourth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	3897.02	30.28**	8pre	18.54	10.28
Within	142	128.69		8post	17.96	12.24
				9post	34.09	11.44

Fifth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	781.11	4.50**	8pre	24.54	11.60
Within	185	173.52		8post	22.09	15.15
				9post	29.16	12.43

Sixth Grade

Analysis of Variance				Means and Standard Deviations		
Source	df	MS	F	Group	Mean	SD
Between	2	3882.79	49.29**	8pre	15.00	6.68
Within	129	78.78		8post	27.50	10.22
				9post	33.38	9.23

**p < .01

CHAPTER V

DISCUSSION AND INTERPRETATIONS

In this chapter the results presented in Chapter IV will be interpreted and discussed in light of the research hypotheses stated earlier. Since the main thrust of this research dealt with the evaluation of the components of the creativity instructional materials and their effects upon the children's creative thinking abilities and language skills, these results will be discussed first. The results discussed are those based on the individual scores analyses since it was desired to generalize to individual pupils rather than to classes. The means analyses did not yield as many significant results; those that were significant there were also significant in the individual scores analyses. As suggested earlier, the major dimension of generalization in this research is to the effect on individuals, not groups. Thus the means analysis is of secondary interest.

The results of this study indicated that certain components of these creativity instructional materials were effective in increasing children's creative thinking abilities. However, the results were selective in that there was no component or combination of the components that was uniformly effective for all three grades over all creativity and language achievement variables. When a treatment condition is designated as effective, that treatment mean differed significantly from the control mean; when a treatment is called more or less effective than another treatment, these means differed significantly from one another also. In general, the treatment conditions were most effective at the fourth grade level. Here at least one treatment was effective for all creativity variables and for language achievement. At the fourth grade, various treatment means differed from the control mean 52 times (of a possible 63 differences). In the fifth grade, two variables were unaffected by any treatment condition: verbal fluency and verbal originality. Here, various treatment means differed from the control mean 38 times of a possible 63 differences. At the sixth grade, there were more variables unaffected by the various treatment conditions than were affected. Those variables which were affected by treatment condition(s) included nonverbal fluency, nonverbal flexibility, and verbal originality; thus of a possible 63 differences, various treatment means differed significantly from the control mean only 12 times.

At all grade levels the single component treatment conditions were generally more effective than the multiple component conditions. Although approximately the same number of single component treatment means differed from the control mean as the number of multiple component means, comparisons among the various treatment conditions indicated that in many cases single component means were significantly greater than those from the multiple component treatments. For all variables, at least one single component condition was greater than the multiple component conditions. For all creativity variables and for both language achievement variables, single and double component treatment conditions were more effective than the triple component treatment condition. Those treatment conditions containing the exercises, either alone or in combination with another component, were generally more effective than those treatment conditions which did not involve the exercises.

Four hypotheses relating to the evaluation of the components of the instructional materials were formulated and used as a basis for interpreting the results. Two additional hypotheses concerning teacher ratings of pupil creativity and teacher creativity tests were also formulated and will be discussed after the results relating to the four primary hypotheses have been interpreted and discussed.

Hypothesis one, that each component of the instructional materials would contribute an equal amount to the growth of the creative thinking abilities and to language achievement, was rejected since the results indicated that certain components did in fact differentially facilitate certain types of creative thinking abilities. The written exercises, where the children had the opportunity to express their ideas in the nonthreatening atmosphere of relatively unevaluated and reinforced practice, proved the most effective component in stimulating creativity and language achievement. For every variable where there was a significant treatment effect, the exercises, either alone or in combination with another component, appeared as at least one of these treatment conditions that was effective. Of the three components, presentations, stories, and exercises, the presentations appeared least often as an effective treatment condition. Thus the various components affected the experimental groups differentially and did not contribute equally to the growth of the creative thinking abilities nor to language achievement.

Hypothesis two, that no two combinations of the components of the instructional package would produce a significantly different amount of growth of the creative thinking abilities than that produced by any other two parts or by the three parts together, was rejected. It was found that certain combinations of the components, especially those with the exercises as a part of the package, facilitated creativity and language achievement more than those combinations without the exercises. The treatment condition with the three parts was the least effective of all multiple components, for although this treatment mean differed from the control mean for all but one variable (verbal fluency), in many cases the single component and double component treatments were more effective than the triple component condition. This treatment was especially ineffective for the sixth grade, since for the variables of verbal fluency, verbal flexibility, language usage, and language total, the control condition was higher than this treatment mean. Perhaps there were sampling problems at this grade, or perhaps something in the interaction of the three components brought about a lesser performance on the criterion test. For many variables, the double component treatment conditions were more effective than the condition containing all the components. Specifically, at the fourth grade level, the two component treatment conditions were more effective for nonverbal and verbal flexibility; at the fifth grade, one or more two component treatments were more effective than the three component treatment for the variables of nonverbal fluency,nonverbal and verbal flexibility, verbal originality, language usage, and language total; at the sixth grade, the two component treatments were superior to the three component treatment for the variables of nonverbal and verbal fluency, nonverbal and verbal flexibility, nonverbal elaboration, language usage, and language achievement. Of the double component treatments, that containing the combination of presentations and stories was least effective, and was not effective for any variables at the sixth grade level. This combination was not effective for variables of verbal fluency and verbal originality. The remaining two double component treatments were each effective for eight of the nine variables. The combination of stories and exercises was ineffective for verbal originality while the combination of presentations and exercises was not effective for verbal fluency.

Hypothesis three, that there would be no differential effects because of sex or grade level on the amount learned from the components of the creativity training materials, was rejected for the variables of nonverbal and verbal fluency, verbal flexibility, nonverbal and verbal originality, nonverbal elaboration, language usage, and language total. It was accepted for the variable of nonverbal flexibility. In general, the fourth graders responded to the various treatment conditions better than did the fifth and sixth graders. At the fourth grade, various treatment means differed from the control mean 52 times, as compared to 38 for the fifth grade, and only 12 for the sixth grade. There were 63 possible comparisons at each grade level.

The various treatment conditions may have been less effective at the sixth grade for several reasons. First, the sixth graders had had two more years of schooling, and thus two more years in which convergent thinking was practiced. Of course, both convergent and divergent thinking skills should be stressed in the schools. But at the present time, there is an imbalance toward convergent thinking. Thus the sixth graders were perhaps less flexible in their productive thinking skills because of the continuous practice and reinforcement of the convergent thinking skills. Thus, even with the additional stimulation for divergent thinking, provided in this research, they still had less facility with this type of productive thinking. Also, the sixth graders may have been increasingly aware of the peer pressures that accompany adolescence. Such peer pressures would also make them less able to respond to the instructional materials in the free-ranging manner intended for the development of divergent thinking abilities. Even though the pupils worked independently, there probably still was much felt pressure to conform. Perhaps there were problems in sampling at this level, so that the teachers included in the study had poorer attitudes toward the materials and influenced their students accordingly. The instructional materials were originally developed for the fourth and fifth grades, and perhaps by administering them to the sixth grade, a ceiling effect was obtained in that they were not suitable for this level.

Sex differences, obtained on the variables of verbal fluency, language usage, and language total, favored the girls, as was expected since girls generally outperform boys on language skills.

Each variable will now be discussed in turn, with the effective treatment conditions noted. Since the treatment conditions will often be referred to by number, a list of these treatment conditions is presented here:

1. Presentations
2. Stories
3. Exercises
4. Presentations and stories
5. Presentations and exercises
6. Stories and exercises
7. Presentations, stories, and exercises
8. No treatment- pretest and posttest

Nonverbal Fluency

At the fourth and fifth grade levels, all treatment conditions were effective. The single component treatments were more effective for the fourth grade pupils than were the multiple component packages. Perhaps the effects of one component counteracted the effects of another component to produce this lesser effect. Or the children may have been overwhelmed by the divergency of materials presented to them at one time. When they were presented with one component, they seemed able to incorporate this single component into their cognitive structure. Treatments with two components, one of which exercises, were the only conditions which were effective at the sixth grade level. Here, too, the treatment with the three components was less effective than any of the conditions with two components. Overall, there were more gains on nonverbal fluency than on any of the eight other variables.

Verbal Fluency

Only at the fourth grade were there any of the treatments effective. The components of stories and exercises were involved in all significant treatment effects, both singly and in combination. At the sixth grade, the three component condition, treatment 7, seemingly produced a negative effect in that the mean for this condition was lower than the mean for the single component condition of exercises, and all two component conditions, as well as the control group.

Nonverbal Flexibility

Nonverbal flexibility was the only variable for which there were no interactions involving the main effect of treatment. All treatment conditions were effective in producing gains on this variable. Treatment 7 was less effective than the single component conditions of stories and exercises, and the two component treatments of presentations and exercises and stories and exercises. Of the single component conditions, the presentations were the least effective, while the exercises were the most effective. Perhaps the pupils had difficulty in handling the ideas presented in the presentations, since they had dealt more often with facts than with ideas in their school experiences; whereas in the presentations they were asked to work with and use ideas rather than facts.

Verbal Flexibility

All treatments were effective at the fourth grade level, but only two treatments, 4 and 5, were effective for fifth graders. Each of the components is represented in one of these two conditions; however, when all three appear in combination, the effect is less than that of the components alone, or in combination of two. Here again the third variable seemed to have a depressing rather than a facilitating effect.

Nonverbal Originality

All treatment conditions were effective for both the fourth and fifth grades, but no treatment was effective at the sixth grade. For the fourth grade, the single component treatments were more effective than the multiple component packages, but this pattern did not hold for the fifth grade.

Verbal Originality

The exercises facilitated verbal originality at both the fourth and sixth grade levels; in addition, treatments 2, 5, and 7 were effective for the sixth grade. There were no treatment effects for the fifth grade. Of the effective treatments for the sixth grade, three of the four contained exercises. Thus, exercises, rather than some other component, seemed to be most facilitative of this prime creativity variable.

Nonverbal Elaboration

All treatment conditions were effective for the fourth grade, treatments 2, 3, 4, 5, 6, and 7 were effective for the fifth grade, but no treatment conditions were effective at the sixth grade. At the sixth grade, the triple component treatment again seemed to have a negative effect; the single component conditions of the stories and the exercises were significantly more effective than the presentations alone. Thus, perhaps it is some interaction between the presentations and the stories which caused the triple component treatment to be less effective.

Language Usage

All treatments were effective for the fourth grade, treatments 2, 3, 4, 5, and 6 were effective for the fifth grade, but none of the treatments were effective for the sixth grade. For the fourth grade, the triple component treatment was less effective than the single component treatment of stories, which was higher than any other treatment. For the fifth grade, all the two-component treatments, as well as the treatment with only the exercises, were more effective than treatment 7. For the sixth grade also, treatment 7 seemed to produce a negative effect, for all single component treatments as well as the combination of presentations and exercises were more effective.

Language Total

All treatments were effective for the fourth grade, treatments 2, 3, 4, 5, and 6 were effective for the fifth grade, but none of the treatments was effective at the sixth grade. At the fourth grade, here, as for language usage, the single component treatment of stories was more effective than the triple component treatment. For the fifth grade, all single and double component treatment conditions were more effective than the triple component treatment. A similar pattern was also evident at the sixth grade: all single component treatments and the treatment containing the presentations and exercises were more effective than treatment 7.

The effects of the creativity instructional materials on language skills is, of course, not unexpected since all three components involved substantial doses of practice in listening or writing. Such substantial practice, even though not directly focused on language instruction, seemed to be effective in increasing language achievement.

The Components

In general, the presentations, alone or in combination with the stories, contributed the least amount to the growth of the creative thinking abilities and to language achievement. The presentations, consisting of an idea or principle about creative thinking, were intended to give the children an opportunity to use skills which they generally did not use every day: manipulating and encoding ideas and abstract verbal principles. Perhaps, after so many years of convergent thinking and encoding fairly concrete principles they could not comprehend how to approach divergent thinking tasks from these abstract directions. Perhaps the length of time during which they were exposed to the presentations, two per week for approximately fourteen weeks, together with the brevity of each presentation (three to four minutes), was too short a time for this new approach to make any kind of measurable difference. The presentations were least effective at the sixth grade level, and this may be explained by the longer time the sixth graders had to close on convergent thinking and to accept peer pressure to avoid creative thinking. One might otherwise suppose that older children could handle ideas and abstract principles more readily than younger children; however, the other effects just mentioned were probably more powerful. At the fourth grade level the children would be more open to new experiences and would also have less experience in convergent thinking. Possibly the fourth graders, just having completed the primary grades with the freer atmosphere, were not as self-critical as the children in the sixth grade had become. Finally the fourth graders would not as yet be affected by the supposed creativity slump (Torrance, 1962).

The component which most facilitated the creative thinking abilities and language achievement was the exercises. Through this component the children had the opportunity to express their wildest ideas in an atmosphere designed to be free enough to permit and even encourage expression of ideas which might have been repressed in a convergent or evaluated situation. The children were encouraged to produce as many ideas as they could, and their teachers were directed to avoid criticism, direction, or other repressive behaviors. The only injunction to the teacher was that the classroom be sufficiently orderly to permit effective listening and writing.

Perhaps the results that were obtained could be attributed simply to an increase in divergent test taking skill. The exercises and the tests were quite similar in that both stressed the production of many clever and unusual ideas. However, the tests have high face or content validity, as well as adequate construct validity for the purposes of this study. Thus, to grow in the test performance skill might be synonymous with growth in divergent thinking.

It is possible that there were problems in the teachers' attitudes toward the material in different treatments. For example, the treatment of presentations alone might have been viewed badly by the teachers. A poor attitude on the part of the teacher could negate any effect of the materials for her class. This problem could have arisen if the teacher knew of another teacher who was using a more complex and apparently more effective or more attractive treatment.

Teacher Ratings of Children's Creativity

Hypothesis five, that there would be no relationship between the teachers' ratings of the children's creative thinking ability and the children's performance on the creative thinking tests, was rejected. Both correlation coefficients (verbal and nonverbal totals) were significant. However, the results indicated that the teachers were able to judge the children's verbal creative ability better than they could the nonverbal creative ability. Perhaps this can be accounted for by the extent to which classroom activity calls for the evaluation of verbal abilities; indeed, there is often little opportunity for the assessment, or even the recognition, of nonverbal creative abilities. It is probable that this was the first time that the teachers had even been asked to rate their pupils' creative abilities. The teachers had the opportunity to listen to the instructional materials at the same time as the children. Perhaps since much emphasis was placed on writing many ideas, and many different kinds of ideas, the teachers thought in terms of verbal creativity when they rated the pupils. Also, the teachers were given brief descriptions of creative behavior stressing verbal creativity to use in rating their pupils. This possibly brought about the higher correlation between the verbal total and the ratings.

It should also be noted that the correlation of these teacher ratings with the posttest creativity scores gives evidence that teachers could reliably evaluate the terminal status of the children after creativity instruction. Thus, teacher ratings could be used as a supplement to the creativity tests.

Teacher Creativity Tests

Hypothesis six, that there would be no relationship between the teacher's and the children's levels of creative ability, was rejected. There was a fairly close relationship between the level of creative ability of the teacher and that of her pupils. Several possibilities are thus apparent. First, this may indicate that the teachers and children have grown together to relatively common levels of divergent thinking ability as a result of the different treatments. Or conversely, it may mean that the children grow toward the teachers' level or the teachers grow toward the level of the class. In either of the latter two cases the possibility of interaction of that effect with instructional treatment would seem likely.

Summary

Results of this research indicate that certain components of the creativity instructional materials were effective in increasing children's creative thinking abilities and language achievement. However, the results were selective in that there was no component or combination of the components that was uniformly effective for all grades over all creativity and language achievement variables. In general, the treatment conditions were more effective at the fourth grade level, where at least one treatment was effective for all creativity variables and for language achievement. At the fifth grade, all but two variables were affected by the instructional materials: verbal fluency and verbal originality. The materials were least effective at the sixth grade where gains were noted on only three variables: nonverbal fluency, nonverbal flexibility, and verbal originality.

At all grade levels, the single component treatment conditions were generally more effective than the multiple component conditions. These treatment conditions containing the exercises, either alone or in combination with another component, were generally more effective than those treatment conditions which did not involve the exercises.

The hypothesized value of presentations of principles of creative thinking and of stories to provide informational content were not well confirmed but the crucial role of exercises or activities in creative thinking was well substantiated.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this research was to evaluate the componential training effects of a series of 28 audio tapes and printed exercises which were designed to develop children's abilities in the divergent thinking functions of originality, flexibility, fluency, and elaboration, and to facilitate their learning of language skills. Specifically, this research was designed to answer the following questions: Do each of the components produce an effect which is significantly different from that produced by other components or combinations of the components? Do each of the components of the instructional package contribute to the growth of the creative thinking abilities and to language achievement? Are there differential effects on the amount learned from the components or combinations of the components of the creativity training materials because of sex or grade level? Are there any interactions among the factors of treatment condition, sex, and grade level which result in differential performance on the criterion tests? Is there a significant relationship between the teacher's ratings of the children's creative thinking ability and the children's performance on the creative thinking tests? Is there a significant relationship between the teacher's and the children's levels of creative thinking?

The training system evaluated consisted of 28 programs each of which consisted of a brief presentation of a principle for creative thinking, a story about an American pioneer, and written exercises stressing creativity and providing an opportunity for unevaluated, reinforced practice.

The sample consisted of 54 classes drawn randomly from a population of approximately 100 fourth, fifth, and sixth grade classes in an urban school system, and assigned randomly to one of nine treatment conditions. There were six classes, two at each grade level, in each treatment group.

Each of the three parts of the training system was presented separately, in pairs, and all together for a total of seven experimental arrangements. In addition, two control groups were used: one group which received both the pretest and the posttest, and another group which received the posttest only. Thus, the nine basic arrangements for experimental evaluation were as follows:

1. Presentation about creativity
2. Stories of pioneers

3. Printed exercises
4. Presentation plus stories
5. Presentations plus exercises
6. Stories plus exercises
7. Presentations, stories, and exercises
8. No treatment- pretest and posttest
9. No treatment- posttest only

Group 9 was subsequently omitted from further analyses because of sampling problems.

Prior to the beginning of the use of the experimental instructional materials, the _Minnesota Tests of Creative Thinking_ were administered to all experimental groups and to the pretested control group as the pretest. The instructional materials were administered by the classroom teacher twice a week for fourteen weeks. Those treatment conditions which used the exercises returned these exercises to the researcher at the end of each two-week period. These exercises were marked "Try harder," "Good, but try harder," "Very good," and "Excellent," and then returned to the children. The purpose in stamping the exercises was to reinforce fluency and elaboration. At the conclusion of the series of 28 programs the _Torrance Tests of Creative Thinking_, Form A (TTCT) were administered to all experimental groups and to both control groups. Data were also gathered for a rating by the teacher for the overall creative ability of each of the pupils in her class. The teachers were given descriptions of creative behavior and were asked to place the pupils in her class into a five category, forced-normal distribution. The TTCT, Form A, was also administered to all participating teachers. In addition, the IQ, age, and grades from the previous year were obtained from the school records. The *Iowa Tests of Basic Skills* were administered by the school system approximately one month after the posttest. These scores were also obtained.

In the statistical evaluation of the treatment conditions, two sets of analyses were conducted: one with the class mean as the unit of observation, and one with the score of each child as the unit of observation. A three-factor factorial analysis of covariance was used, with the various combinations of the components of the instructional package, presentations, stories, and exercises, accounting for the eight levels of the treatment factor, grade, with three levels, (4, 5, and 6) and sex, with two levels. The pretest scores were used as the covariates in assessing the amount of change or growth resulting from the components of the instructional materials as reflected in terminal scores. For the verbal creativity variables, IQ and language achievement scores were added as covariates. IQ was used as the covariate for the language achievement scores. These analyses provided tests for the principal hypotheses concerning the effects of the materials upon the children's creative thinking abilities and language skills. The hypothesis dealing with the teacher's rating of the pupils' creative abilities was tested by means of correlations run between the pupils' standardized posttest scores, verbal and nonverbal totals, and the teacher's rating of their creative abilities. The hypothesis concerned with the relationship between the teacher's and the pupils' creative abilities was tested by means of a canonical correlation between the teacher's scores on the tests of creative thinking and the average scores for her class on the posttest.

Results of this research indicate that certain components of the creativity instructional materials were effective in increasing children's creative thinking abilities and language achievement. However, the results were selective in that there was no component or combination of the components that was uniformly effective for all grades over all creativity and language achievement variables. In general, the treatment conditions were most effective at the fourth grade level, where at least one treatment was effective for all creativity variables and for language achievement. At the fifth grade, all but two variables were affected by the instructional materials: verbal fluency and verbal originality. The materials were least effective at the sixth grade where gains were noted on only three variables: nonverbal fluency, nonverbal flexibility, and verbal originality.

At all grade levels, the single component treatment conditions were generally more effective than the multiple component conditions. Those treatment conditions containing the exercises, either alone or in combination with another component, were generally more effective than those treatment conditions which did not involve the exercises.

The hypothesized value of presentations of principles of creative thinking and of stories to provide informational content were not well confirmed, but the crucial role of the exercises or activities in creative thinking was well substantiated.

Conclusions

This research has yielded the following conclusions:

1. These instructional materials facilitate development of the creative thinking abilities of fourth grade children, and that they become less effective as the age of the child increases.

2. The exercises are the most potent component of these materials.

3. The triple component treatment is the least effective of all multiple component packages.

4. These materials are more facilitative of nonverbal fluency than of any other creativity or language achievement variable measured in this research.

5. The single component treatments were generally more effective than the multiple component treatments.

6. The teachers tended to rate verbal creativity rather than nonverbal creativity when rating pupil creativity.

7. The levels of the teacher's and the children's creative thinking abilities are fairly closely related.

A crucial concern of this research was to establish a model for componential evaluation of instructional materials. The design of this study was unique in its approach to the evaluation of the components. A criticism of single comparative studies that crude comparisons among widely differing methods yield no information on what elements produced effects, is here reduced. A componential analysis does answer many questions heretofore unresolved in studies of multi-component materials.

Furthermore, a componential analysis can yield more information about fundamental aspects of instruction and learning. The components can be various types of instruction as they were in this study: presentations of principles, provision of information to be processed, and exercises or activities. Results then indicate the relative effectiveness of various components of the instructional materials.

The design of this research involved multiple outcomes, all of which were relevant to the treatments and of interest to the researcher. It has been shown that multiple treatments and outcome variables could be evaluated in an organized manner in one complex design.

It should also be noted that the research design used in this study involving 54 classrooms and substantial cooperation from many people in and out of the school system was conducted with a minimum of problems and difficulties. This suggests that when public school personnel and university researchers cooperate in research and when the various administrative roles are efficiently carried out, the research can produce generalizable results for schools in general.

BIBLIOGRAPHY

BIBLIOGRAPHY

Allen, M. S. Morphological creativity. Englewood Cliffs, N.J.: Prentice-Hall, 1962.

Bahlke, S. J. A study of the enhancement of creative abilities in elementary school children. Unpublished master's thesis, Purdue University, 1967.

Binet, A. Les idees modernes sur les enfants. Paris: Ernest Flamarion. 1909. (Cited from Hunt, 1961).

Brown, G. I. An experiment in the teaching of creativity. School review, 1964, 72, 437-450.

Brown, G. I. A second study in the teaching of creativity. Harvard educational review, 1965, 35, 39-55.

Campbell, D. T., & Stanley, J. C. Experimental and quasi-experimental designs for research. In N. L. Gage (Ed.), Handbook of research on teaching. New York: Rand McNally, 1963.

Cartledge, C. J. & Krauser, E. L. Training of first-grade children in creative thinking under quantitative and qualitative motivation. Journal of educational psychology, 1963, 54, 295-299.

Clark, N. W. A study of the relationship of creativity, preference for open-structure learning experiences, and teacher-like for pupils in grades three through six. Unpublished master's thesis, Cornell University, 1965.

Cooley, W. W. & Lohnes, P. R. Multivariate procedures for the behavioral sciences. New York: Wiley, 1962.

Covington, M. V., & Crutchfield, R. S. Facilitation of creative problem solving. Programed instruction, 1965, 4, 3-5, 10.

Crawford, R. P. Techniques of creative thinking. Englewood Cliffs, N.J.: Hawthorn, 1954.

Crutchfield, R. S. Teaching for productive thinking in children. An invited address at the Annual Convention of the American Psychological Association, New York City, September, 1966.

Crutchfield, R. S. & Covington, M. Programed instruction and creativity. *Programed instruction*, 1965, 4, 1-2, 8-10.

Darwin, C. *Origin of the species*. London: Murray, 1859. (Cited from Hunt, 1961).

Edwards, M. O. A survey of problem-solving courses. *Journal of creative behavior*, 1967, 2, 1, 33-51.

Eisner, E. W. Children's creativity in art: a study of types. *American educational research journal*, 1965, 2, 125-136.

Enochs, P. D. An experimental study of a method for developing creative thinking in fifth grade children. Unpublished doctoral dissertation, University of Missouri, 1964.

Erickson, G. A predictive validity study of a test of creative thinking ability and peer nomination on creativity criteria. Unpublished master's thesis, University of Minnesota, 1966.

Fletcher, H. J. Possible interpretative problems in analyses using group means as the experimental unit. *Psychological bulletin*, 1968, 69, 157-160.

Forehand, G. A., & Libby, W. L. Effects of educational programs and perceived organizational climate upon changes in innovative administrative behavior. In *Innovative Behavior*. Chicago: University of Chicago, Center for Programs in Government Administration, 1962.

Gagne', R. M. Military training and principles of learning. *American psychologist*, 1962, 17, 83-91.

Gallagher, J. J. Productive thinking. In M. I. Hoffman & L. W. Hoffman (Eds.), *Review of child development research*. New York: Russell Sage Foundation, 1964.

Goralski, P. S. Creativity: student teachers' perceptions of approaches to classroom teaching. Unpublished doctoral dissertation, University of Minnesota, 1964.

Gourlay, M. Covariance analysis and its application in psychological research. British journal of statistical psychology, 1953, 6, 25-34.

Grover, B. L. Some effects and correlates of different types of practice used in studying a topic in ninth grade classrooms. Unpublished doctoral dissertation, University of Minnesota, 1963.

Guilford, J. P. Creativity. American psychologist, 1950, 5, 444-454.

Guilford, J. P. Creativity: yesterday, today, tomorrow. Journal of creative behavior, 1967a, 1, 3-15.

Guilford, J. P. The nature of human intelligence. New York: McGraw-Hill, 1967b.

Guilford, J. P. Three faces of intellect. American psychologist, 1959, 14, 469-479.

Hamburg, M. S. A study of the relationship of creativity, preference for open-structure learning experiences, and teachers likes and dislikes of children in grades 3-6. Unpublished master's thesis, Columbia University, 1964.

Holland, J. L. Some limitations of teacher ratings as predictors of creativity. Journal of educational psychology, 1959, 47, 490-503.

Hilgard, E. R. Creativity and problem solving. In H. H. Anderson (Ed.), Creativity and its cultivation. New York: Harper & Row, 1959.

Hunt, J. McV. Intelligence and experience. New York: Ronald Press, 1961.

Linden, J. D., & Linden, K. W. Tests on trial. Boston: Houghton Mifflin, 1968.

Lindquist, E. F. Statistical analysis in educational research. Boston: Houghton Mifflin Co., 1940.

Lindquist, E. F., & Hieronymus, A. N. Manual for Administrators, supervisors, and counselors for ITBS. Boston: Houghton Mifflin, 1964.

Lord, F. M. Large sample covariance analysis when the control variable is fallible. Journal of the American statistical association, 1960, 55, 307-321.

Long, B. H., & Henderson, E. H. Opinion formation and creativity in elementary school children. *Psychological reports*. 1965, 17, 219-223.

Lumsdaine, A. A. Instruments and media of instruction. In N. L. Gage (Ed.), *Handbook of research in teaching*. Chicago: Rand McNally, 1963.

Mackler, B. Creativity and life style. Unpublished doctoral dissertation, University of Kansas, 1962.

Maltzman, I. On the training of originality. *Psychological review*, 1960, 67, 229-242.

Maltzman, I., Simon, S., Raskin, D., & Licht, L. Experimental studies in the training of originality. *Psychological monographs*, 1960, 74, No. 6 (Whole No. 493).

Maslow, A. H. Creativity in self-actualizing people. In H. H. Anderson (Ed.), *Creativity and its cultivation*. New York: Harper & Bros., 1959.

Meadow, A. & Parnes, S. J. Evaluation of training in creative problem-solving. *Journal of applied psychology*, 1959, 43, 189-194.

Mooney, R. & Razik, T., (Eds.), *Explorations in creativity*. New York: Harper & Row, 1967.

Olton, R. M., & Crutchfield, R. S. Developing the skills of productive thinking. In P. Mussen, J. Langer, & M. V. Covington (Eds.), *New directions in developmental psychology*. New York: Holt, Rinehart, & Winston, 1969.

Olton, R. M., Wardrop, J. L., Covington, M. V., Goodwin, W. L., Crutchfield, R. S., Klausmeier, H. J., & Ronda, T. *The development of productive thinking skills in fifth grade children*. Madison, Wis.: Center for Cognitive Learning, University of Wisconsin, Technical Report No. 34, 1967.

Osborn, A. E. *Applied imagination*. New York: Chas. Scribner's Sons, 1963.

Parnes, S. J. Education and creativity. *Teachers college record*, 1963, 64, 331-339.

Parnes, S. J. Effects of extended effort in creative problem-solving. *Journal of educational psychology*, 1961, 52, 117-122.

Parnes, S. J. & Brunelle, E. A. The literature of creativity (part 1). Journal of creative behavior, 1967, 52-109.

Patrick, C. Whole and part relationship in creative thought. American journal of psychology, 1941, 54, 128-131.

Ripple, R. E. & Dacey, J. The facilitation of problem-solving and verbal creativity by exposure to programed instruction, Psychology in the schools, 1967, 4, 240-245.

Rogers, C. R. Toward a theory of creativity. In H. H. Anderson (Ed.), Creativity and its cultivation. New York: Hastings House, 1959.

Rouse, S. T. Effects of a training program on the productive thinking of educable mental retardates. American journal of mental deficiency, 1965, 69, 666-673.

Smith, J. A. Setting conditions for creative teaching in the elementary school. Boston: Allyn and Bacon, 1966.

Sommers, W. S. The influence of selected teaching methods on the development of creative thinking. Unpublished doctoral dissertation, University of Minnesota, 1961.

Taylor, C. W. Creativity through instructional media: a universe of challenges. In C. W. Taylor & F. W. Williams (Eds.), Instructional media and creativity. New York: Wiley, 1966.

Taylor, C. W. Questioning and creating: a model for curriculum reform. Journal of creative behavior, 1967, 1, 22-33.

Taylor, C. W., & Holland, J. L. Development and application of tests of creativity. Review of educational research, 1962, 62, 91-102.

Taylor, I. A. The nature of the creative process. In P. Smith (Ed.), Creativity: an examination of the creative process. New York: Hastings House, 1959.

Torrance, E. P. Education and the creative potential. Minneapolis: University of Minnesota Research Bureau, 1963.

Torrance, E. P. Education and creativity. In C. W. Taylor (Ed.), *Creativity: progress and potential*. New York: McGraw-Hill, 1964.

Torrance, E. P. Examples and rationales of test tasks for assessing creative abilities. *Journal of creative behavior*, 1968, 2, 165-179.

Torrance, E. P. *Minnesota Tests of Creative Thinking*, Abbreviated Form VII, Minneapolis: University of Minnesota Bureau of Educational Research, 1962.

Torrance, E. P. The Minnesota studies of creative behavior: national and international extension. *Journal of creative behavior*, 1967, 2, 137-154.

Torrance, E. P. *Rewarding creative behavior: experiments in classroom creativity*. Englewood, N.H.: Prentice-Hall, 1965.

Torrance, E. P. *Torrance Test of Creative Thinking: Norms and technical manual*. Princeton, N.J.: Personnel Press, 1966.

Torrance, E. P. *Torrance Tests of Creative Thinking, Verbal A and Figural A*. Princeton, N.J.: Personnel Press, 1966.

Torrance, E. P. & Gupta, R. *Programed experiences in creative thinking*. Minneapolis: Bureau of educational research, 1964.

Torrance, E. P. & Hansen, E. The question asking behavior of highly creative and less creative basic business teachers identified by a paper and pencil test. *Psychological reports*, 1965, 17, 815-817.

Torrance, E. P. & Myers, E. E. *Teaching gifted elementary pupils how to do research*. Minneapolis: Perceptive Publishing Co., 1962.

Treffinger, D. J. The effects of programed instruction on productive thinking in verbal creativity and problem-solving among pupils in grades four, five, six, and seven. Unpublished doctoral dissertation, Cornell University, 1969.

Treffinger, D. J., Ripple, R., & Dacey, J. S. Teachers' attitudes about creativity. *Journal of creative behavior*, 1968, in press.

True, G. H. Creativity as a function of idea fluency, practicability, and specific training. Unpublished doctoral dissertation, State University of Iowa, 1956.

Underwood, B. J. Ten years of massed practice and distributed practice. *Psychological review*, 1961, 68, 229-247.

Wallach, M. A. & Kogan, N. *Modes of thinking in young children*. New York: Holt, Rinehart and Winston, 1965.

Wallas, G. *The art of thought*. London: C. A. Watts, 1943.

Weber, W. A. Relationships between teacher behavior and pupil creativity in the elementary school. Paper presented at the annual meeting of the American Educational Research Association, Chicago, February, 1968.

Williams, F. E. Conference overview with models and summary lists of tenable ideas and research areas. In C. W. Taylor & F. W. Williams (Eds.), *Instructional media and creativity*. New York: Wiley, 1966.

Williams, F. E. Intellectual creativity and the teacher. *Journal of creative behavior*, 1967, 2, 173-180.

Winer, B. J. *Statistical principles in experimental design*. New York: McGraw-Hill, 1963.

Weisberg, P. A. & Springer, K. J. Environmental factors in creative function. *Archives of general psychology*, 1961, 5, 554-564.

Wodtke, K. H. A study of the reliability and validity of creativity tests at the elementary school level. Unpublished doctoral dissertation, University of Utah, 1963.

Yamamoto, K. *Experimental scoring manuals for Minnesota Tests of Creative Thinking and Writing*. Kent, Ohio: Bureau of Educational Research, Kent State University, 1964.

APPENDIX A

APPENDIX A

Directions to Teachers for Creativity Ratings

1. From the following table, select the line with the number of pupils in your class shown in column 1. Transfer the numbers on that line to the boxes at the tops of columns A, B, C, D, and E on the attached chart.

Column 1 number of pupils	A	B	C	D	E
14-20	1	3	remainder in class	3	1
21-25	2	4	"	4	2
26-30	3	5	"	5	3
31-35	4	6	"	6	4
36-40	5	7	"	7	5

2. After filling in the numbers in the boxes, print the names of your pupils on the numbered lines in the columns starting with #1 in each column and following the numbers. Use the following criteria as guides:

   Column A: Please print the names of those children in your class who are the least creative. These are the children who never seem to have any original ideas, are usually not very productive, and who prefer to use the ideas of others rather than to generate their own.

   Column B: Those children in your class who have a slight amount of creative ability, but who exhibit this ability only rarely. They sometimes have clever and interesting ideas, but generally prefer to depend upon others ideas.

   Column C: Those children in your class who have an average amount of creative ability. They have some clever and original ideas, and are about average in the number of ideas they produce. Sometimes they prefer to use the ideas of others, but often they prefer to use their own ideas.

Column D: Those children in your class who are quite creative. They have many ideas, some of which are unusual and interesting. These are the children who often have original ideas, are above average in productivity and who prefer to use their own ideas.

Column E: Those children in your class who are the most creative. They always seem to be "bubbling over" with ideas, most of which are clever and interesting. They prefer to use their own ideas rather than the ideas of others.

3. At the bottom of each column beside the letters B and G, please write the number of Boys and the number of Girls whom you have listed in that column.

Teacher: ______

Treatment: ______

School: ______

Grade: ______

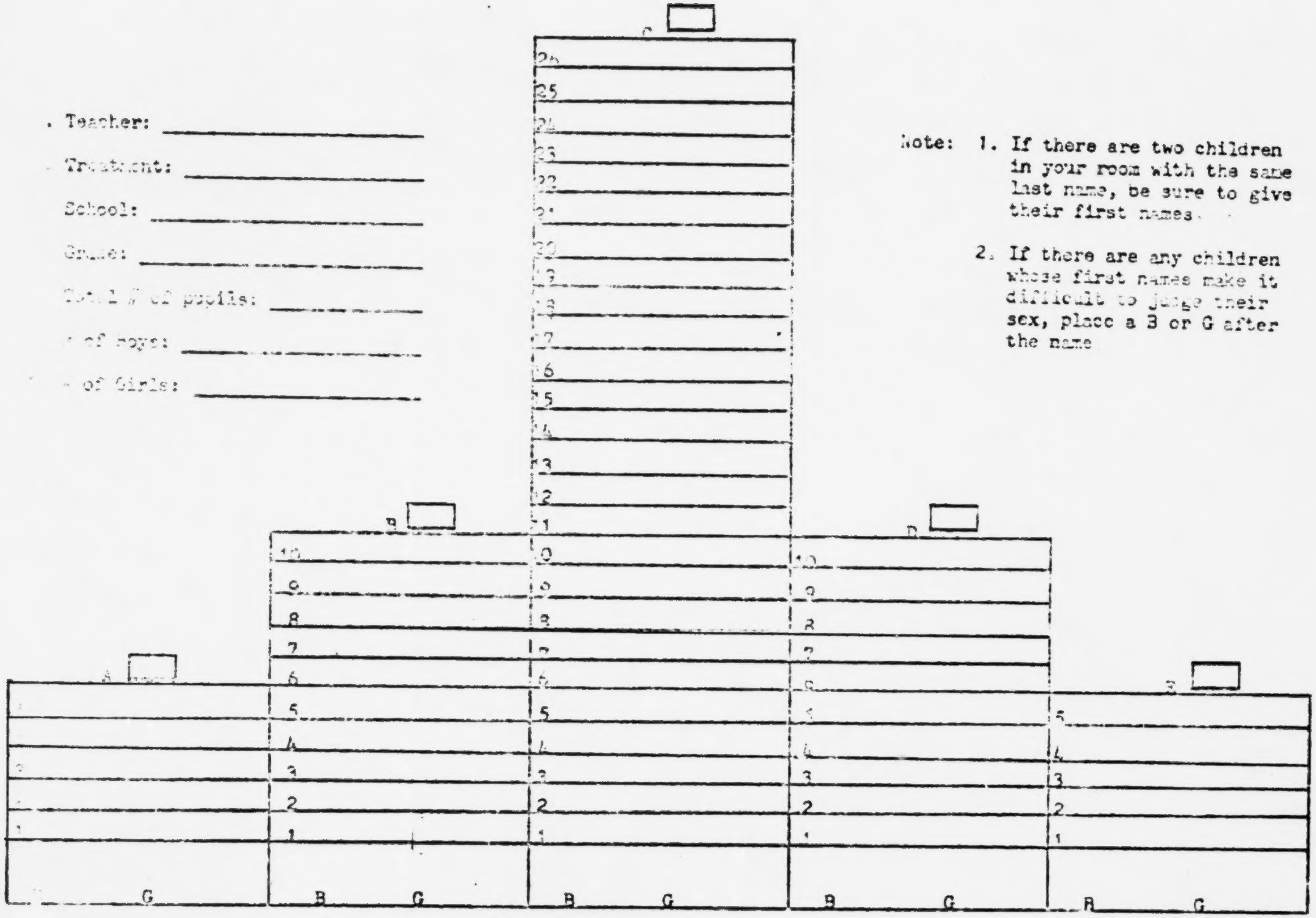
Total # of pupils: ______

# of boys: ______

# of Girls: ______

Note: 1. If there are two children in your room with the same last name, be sure to give their first names.

2. If there are any children whose first names make it difficult to judge their sex, place a B or G after the name.



VITA

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Starks, David D., Feldhusen, John F., Bahlke, Susan J., and Ferris, Donald. "Teaching Creativity Using Audio Tapes." Paper presented at the annual meeting of the National Council on Measurement in Education, New York, Feb. 16-18, 1967.

Bahlke, Susan J. and Georgeoff, P. John. "The Effect of the Curriculum on Racial Cleavage in Integrated Fourth Grade Classrooms." Paper presented at the annual meeting of American Educational Research Association, Chicago, Feb. 8-10, 1968.

Bahlke, Susan J., and Feldhusen, J. F. Componential Evaluation of Creativity Instructional Materials. Paper to be presented at American Educational Research Association, Feb. 7-10, 1969 Los Angeles, California.

Publications

Bahlke, Susan J. A Study of the Enhancement of Creative Abilities in Elementary School Children. Unpublished Master's thesis, Purdue University, January, 1967.

Georgeoff, John and Bahlke, Susan. *Gary Achievement Test on American Negro History and Culture*. Research instrument, mimeo, Dept. of Ed., Purdue University, 1968.

Georgeoff, P. John, Jones, Imogene, and Bahlke, Susan J. "The Effect of the Curriculum on Racial Cleavage in Integrated Fourth Grade Classrooms." *Contemporary Education*. In press.

Bahlke, Susan J., Feldhusen, J. F. and Starks, D. D. "Teaching Creative Thinking," Submitted to the *Journal of Educational Research*.